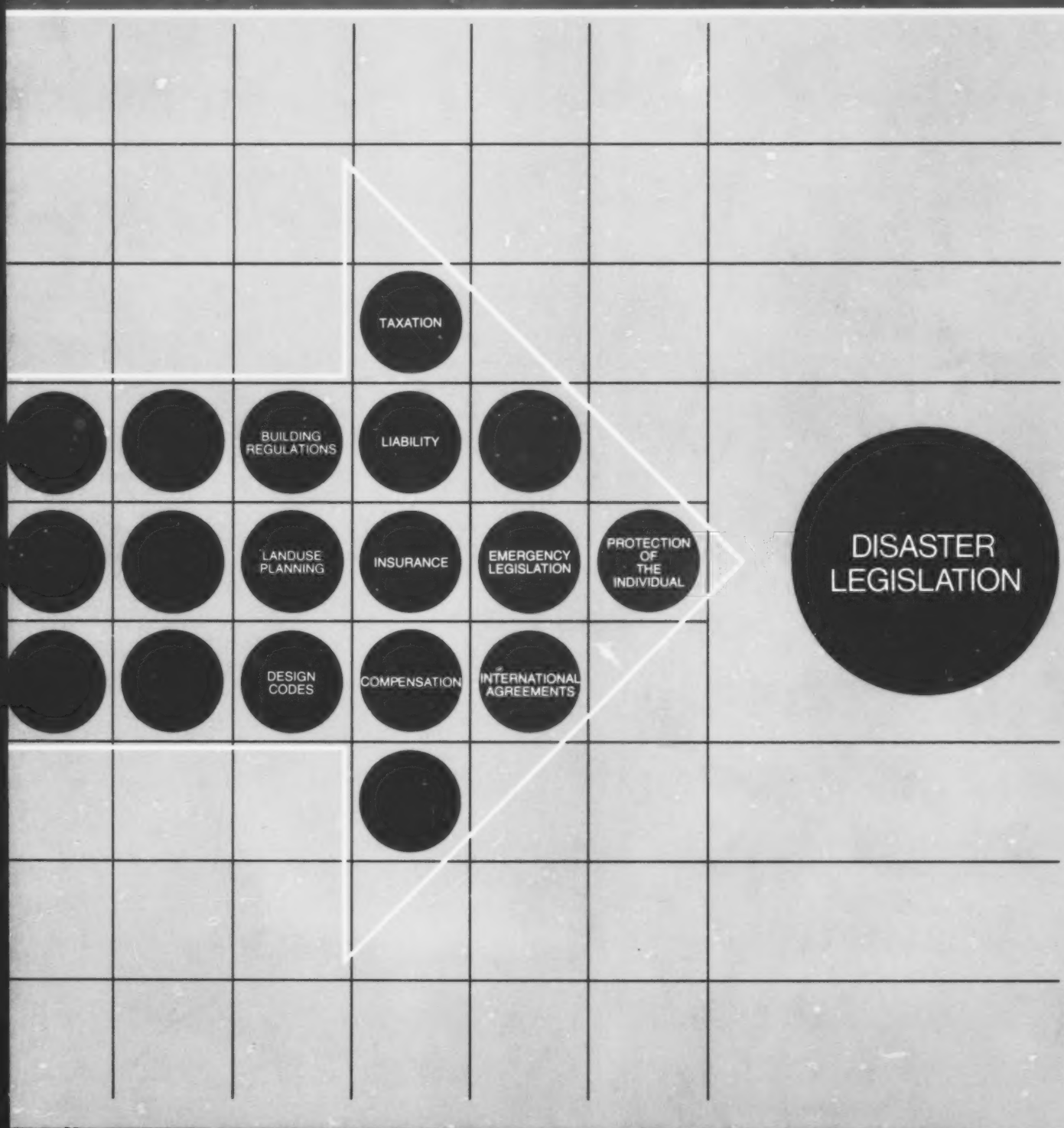
Disaster Prevention and Mitigation

A Compendium of Current Knowledge

UNITED NATIONS

VOL. 9. LEGAL ASPECTS



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Disaster Prevention and Mitigation

A Compendium of Current Knowledge

Volume 9

LEGAL ASPECTS

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FOREWORD

The Office of the United Nations Disaster Relief Co-ordinator (UNDRO) presents the ninth volume in the series entitled "Disaster Prevention and Mitigation". The purpose of these publications is to provide the international community with a comprehensive review of existing knowledge of the causes and characteristics of natural phenomena and the preventive measures which may be taken to reduce or eliminate their impact on disaster-prone developing countries.

These volumes are prepared in accordance with General Assembly resolution 2816 (XXVI), which calls upon the Office of the United Nations Disaster Relief Co-ordinator to promote the study, prevention, control and prediction of natural disasters, including the collection and dissemination of information on technological developments.

The aims of these studies are, first, to identify the existing knowledge and expertise which may be applied directly toward the prevention of natural disasters, particularly in developing countries and, secondly, to identify the gaps in current knowledge which require concerted action by the international community.

During the last two decades the international community has become increasingly alarmed by disasters, which have tended to be more destructive as they affect ever larger concentrations of population. While the response of the international community has been focussed primarily on relief action, it is now realized that the actual and potential consequences of disasters are becoming so serious and increasingly global in scale, that much greater emphasis will henceforth have to be given to planning and prevention. The effects of natural phenomena must be viewed not only in humanitarian and broad social terms, but also - and primarily - in economic terms.

Natural disasters are a formidable obstacle to economic and social development. In terms of percentage of gross national product, the losses caused by disasters in some disaster-prone developing countries more than cancel out any real economic growth. There has thus been a growing awareness by Governments of the need to focus more attention on disaster preparedness and prevention, and a recognition of the fact that disaster prevention and pre-disaster planning should be an integral part of national development policy.

The "International Strategy for Disaster Prevention", proposed by UNDRO and approved by the General Assembly at its twenty-ninth and thirtieth sessions, will provide the conceptual framework for national and international action in the prevention and mitigation of natural disasters. This strategy will harness the collective human and material resources of the world towards removing the scourge which natural disasters represent for many disaster-prone developing countries. The present series on "Disaster Prevention and Mitigation" provides one of the inputs for the formulation of the strategy.

All the publications in the series "Disaster Prevention and Mitigation" are addressed to a broad range of users, including high-level government officials, administrators, technical experts in the field and specialists in the various areas of disaster prevention. They are also designed to guide officials at the national and regional level in the formulation of policies for preventive measures against the types of natural phenomena affecting their region.

The Office of the United Nations Disaster Relief Co-ordinator invites the readers of this volume, Legal Aspects, to provide the United Nations with their comments and suggestions.

This publication was prepared by the Office of the United Nations Disaster Relief Co-ordinator in collaboration with Mr. Dennis J. Driscoll. The production of this volume, as well as the other monographs in this series, was made possible by the active co-operation of the United Nations Environment Programme (UNEP).

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I. INTRODUCTION

This publication examines the legal aspects of disaster prevention and mitigation. The law can in various ways direct new human settlements away from hazard-prone areas and also assist in mitigating the risk of disaster in presently occupied areas. In the absence of coherent legal policies for disaster prevention, the law might have the effect of actually facilitating disasters, indeed to some extent even guaranteeing them. For example, high taxation may co-erce a property owner to develop his land in a flood zone in order to permit him to pay the taxes on his property's high development value; yet, developing on the floodplain has the effect of changing the land's run-off characteristics and thereby increasing the likelihood and the ultimate severity of floods. Thus the relationship of law to problems posed by disaster prevention is at once pervasive and profound.

The primary purpose of this study is to discuss the legal strategies most likely to prevent or mitigate disasters. A secondary purpose is to highlight the legal tensions between the interests of the individual and the community which may arise from the adoption of the techniques discussed. It must be recognized that however desirable certain measures of land-use control may appear to be for disaster prevention, such measures may nonetheless also constitute significant infringements of vested property rights: land may be zoned to prevent development; land may be compulsorily acquired by the authorites; hazardous buildings may have to be improved or demolished altogether. Moreover, many of these measures may be non-compensable. Thus, a tension is established between the constitutional rights of the individual and pressing collective interest, i.e., the common good. The purpose of the law is to reconcile these conflicting claims in a manner satisfactory to the individual and to society.

Chapter II of this study discusses the strategies presently available to prevent disasters or to mitigate their effects. The

most noteworthy legal tools for these purposes are zoning, subdivision and building regulations. Yet disasters will inevitably occur, either because appropriate disaster-prevention strategies have not been adopted or enforced, or because the destruction attendant upon some natural phenomena cannot be prevented by traditional measures of building and land-use control. Chapter III outlines the problems involved in the establishment and execution of disaster preparedness plans.

For many of the legal problems discussed in Chapters II and III, information about the practices of developing countries has been scanty. None of the problems has ever been subjected to rigorous, comparative analysis. Many of the problems found in Chapter III have never been the subject of legal study at all. Therefore, only tentative comments can be offered. On the basis of the information at present available to UNDRO, the comments are believed to be true. Future research will confirm or deny the validity of many of the findings. Moreover, one principal conclusion of the study is that legal research is urgently required in all areas of disaster prevention and mitigation.

Finally, technological developments are likely to play an increasingly important role in disaster-related fields. Chapter IV of the study contains a brief discussion of the two technological developments with the greatest significance for disaster prevention and mitigation: weather modification activities and remote sensing by satellite.

II. LEGAL ASPECTS OF DISASTER PREVENTION

2.1 General

It is important to appreciate that a number of traditional legal devices can be adapted to meet the environmental challenges posed by natural phenomena as diverse as earthquakes and tropical storms. The most absolute legal measure rests in the power of the State to acquire property for any public purpose provided that compensation is paid. But, in addition, the State can also 'regulate' the use to which property is put, and such governmental limitations on the mere 'use' of property do not require compensation. The right to 'regulate', on a non-compensable basis, the use to which property may be put rests in the sovereign right of the State to legislate in order to promote public health, safety and welfare.

If the matter were as simple as that, devices such as zoning and sub-division regulations would be fairly economical and straightforward tools in disaster prevention. Land on a floodplain, for example, could simply be zoned for agricultural or recreational use at no cost to the community, and yet the community would benefit. The problem is that courts in many countries have recognized that the regulation of property rights may be so severe as to become, in effect, a 'taking' of property by the State. In most countries such a 'taking' is unconstitutional unless compensation is paid. To introduce a further subtlety, it is often difficult to establish in practice whether property has been 'taken' by the State or whether its use has merely been 'regulated'.

This chapter begins with an analysis of the above considerations as they apply to zoning, sub-divison and building regulations. It will be seen that perhaps the most intractable problem is that these regulations are not enforced as strategies for disaster prevention throughout much of the developing world. Hence the more drastic and categorical measure of public acquisition of land assumes great significance as an alternative strategy. The strategy is limited,

however, by the cost of the common constitutional requirement to provide just compensation for property taken by the State. Comments on the relevance of taxation and insurance to a coherent disaster-prevention policy are also included.

2.2 Legal Problems Arising from Restrictions on Land Use

2.2.1 Zoning Regulations[1/]

The zoning of land refers to the division of land into broad land-use districts (such as residential, industrial, agricultural and recreational) and the prescription of regulations within those districts, among other things, for the height and bulk of buildings, floor area rations, population density, set-back regulations, and the percentage of lot occupancy. The usefulness of zoning regulations as a strategy in land-use control for disaster prevention is obvious. Previous studies in this series have emphasized the spatial aspect of natural disasters: although the precise timing of a disaster may be a matter of considerable doubt, it is often known with greater certainty where the disaster will occur. This knowledge has clear legal implications. Zoning regulations become a very useful tool in guiding development away from likely disaster-prone areas, such as floodplains and fault zones, and towards safer areas.

It can be argued that zoning deprives a person of property without due process of law. The value of land depends upon its development potential. If land otherwise suitable for industrial or other development is zoned, as a result of disaster prevention considerations, for open space or recreational purposes, its economic value is in all likelihood greatly diminished. Seen in this light, it can be argued that zoning is a 'taking' of property

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1/ For a general treatment of zoning regulations, see Robert M. Leary, "Zoning", in William J. Goodman (ed.), Principles and Practice of Urban Planning, Washington, D.C.: International City Managers' Association, 1968, pp. 403-442. See also Disaster Prevention and Mitigation, Vol. V, Land Use Aspects, UNDRO, Geneva, 1977.

without payment of just compensation. Such action by the State is prohibited in most national constitutions. For example, Article 45 of the Constitution of Costa Rica provides:

> Property is inviolable; no one may be deprived of what is his except for legally proven public interest after compensation in accordance with the law.2/

Despite the possible broad constitutional challenge stated in the previous paragraph, zoning has generally been upheld as constitutional on the grounds that it is a valid exercise of the right of the State to promote public welfare. Zoning, and in particular zoning for disaster prevention, can be seen as a strategy which is directly related to the protection of public safety. As a legal tool, therefore, zoning is not so clearly arbitrary or unreasonable as to be declared unconstitutional by the courts. This does not mean, however, that a particular zoning regulation is valid. Each zoning regulation must be seen to bear a reasonable relationship to the protection of public safety or the general welfare — the ends for which it was enacted. This relationship would not exist if the zoning regulation were not based on adequate scientific data. Thus the importance of risk analysis, discussed in an earlier study,3/ takes on a second, and legal, significance. In the absence of risk analysis, the zoning regulation may be found to be arbitrary or unreasonable, and therefore invalid. Most of the successful constitutional challenges to disaster-related zoning regulations have been based on this point.

2/ See also, for example, the constitutions of Paraguay, Article 93; Kuwait, Article 18; the Philippines, Article 3; Turkey, Article 38; and Peru, Article 29. See also The Universal Declaration of Human Rights, Article 17.

3/ Disaster Prevention and Mitigation, Vol. V, Land Use Aspects, UNDRO, Geneva, 1977.

It is appropriate to emphasize here that the zoning regulation should be based on comprehensive area development plans. These plans also have a legal significance. The greatest constitutional challenges that zoning regulations have faced hitherto have been based on their 'arbitrariness' or 'unreasonableness' on the grounds of lack of adequate data or of an adequate comprehensive plan. Hence a comprehensive plan constitutes a guarantee of the reasonableness of the regulation. It may be that, ultimately, after weighing the evidence relating to the public interest and the rights of the private owners of the regulated properties, a court may decide that the public interest is so slight or the deprivation of the owners is so great that the zoning regulation is unreasonable under the circumstances; nevertheless, a comprehensive plan, based on risk analysis, is the best possible guarantee that the regulation is reasonable in the circumstances and is therefore a valid exercise of the right of the State to promote public safety.

A comprehensive plan also ensures, as far as practicable, that the zoning regulation is non-discriminatory. The problem of discriminatory treatment constitutes a particular difficulty in zoning regulations because, unlike other municipal regulations (such as the provisions of the building code) which apply uniformly throughout the municipality, zoning regulations differ from one district to another. For example, one district may have different height and setback provisions from another. This feature of zoning carries with it the real danger that municipal authorities may give arbitrary or discriminatory, hence unconstitutional, treatment to individual property owners. As a result, a well-drafted enabling act, while permitting regulations to differ from district to district, will require that within a given district the regulations must be uniform for each class and kind of building. Additionally, there must be a reasonable basis for classifying particular districts differently from others. This again draws attention to the importance of proper risk analysis.

The next common problem with regard to zoning regulations is jurisdictional. It is imperative that the regulations comprehend all areas of growth. In reality, however, many zoning enabling acts restrict the powers granted to municipalities to areas within municipal limits. Yet, because much of the new development takes place outside existing municipal limits, the zoning regulations are powerless to control a high proportion of the development most in need of legal regulation. It will be seen below that this problem is also unfortunately true of sub-division regulations. When planning and building entirely new settlements, it is important to establish zoning regulations at the earliest stages in order to forestall later problems. The enforcement of zoning and other land use regulations is thus an essential aspect of disaster mitigation.

The matters referred to in the previous paragraphs refer to the principal formal legal problems relating to zoning regulations. Now it is necessary to discuss the most important practical difficulty in the successful use of zoning as a strategy in disaster prevention: the problem of the administration of the regulations themselves. Zoning regulations are enforced systematically in few developing countries, and in many developing countries such regulations are not enforced at all. To take one example, a zoning ordinance was passed for Beirut in 1954, but no attempt at all was made to enforce it. As a consequence, mixed-use districts proliferated and the ordinance became a practical irrelevancy, although still binding in law. 4/ The non-enforcement of land-use controls is perhaps the most acute of all legal problems facing developing countries intent on adopting measures of disaster prevention, and this problem is given further treatment below because of its general significance.

4/ Urban Land Policies and Land-Use Control Measures, Vol. V, Middle East (ST/ECA/167/Add.4), United Nations, New York, 1973 (Sales No. E.73.IV.9).

A second practical difficulty in using zoning as a realistic land-use strategy is that so much of urban construction in the developing world consists of slums and uncontrolled settlements. The orderly development which zoning implies can only with difficulty be extended to situations where much of the development is uncontrolled and seemingly uncontrollable.

However, by means of slum and squatter upgrading and improvement programmes, which are increasingly in evidence in the developing countries, zoning and density adjustments can be achieved, especially if these are perceived by the communities concerned to be in their best interests, or if sufficient incentives are provided, such as security of tenure on re-located sites, home improvement loans and better sanitation.

Despite the potential usefulness of zoning as a strategy in land-use control for disaster prevention, its success in the past as a general land-use control has been modest at best.[5/] Even in developed countries, such as the United States of America, France and Canada, the problem of non-enforcement and the liberal granting of zoning variances have compromised its success. As a result, the control imposed by subdivision regulations has grown in importance.

2.2.2 Sub-division Regulations [6/]

The sub-division of land refers to the division of land into two or more parcels for the purpose of sale or building development.

5/ Urban Land Policies and Land-Use Control Measures, Vol. III, Global Review, (ST/ECA/167/Add.6), United Nations, New York,1975 (Sales No. E.73.IV.11).

6/ For a general treatment of subdivision regulations, see Philip P. Green, Jr., "Land Subdivision", in William J. Goodman (ed.), Principles and Practice of Urban Planning, Washington,D.C: International City Managers' Association, 1968.

It is essentially a process of converting raw land into building sites. In many countries this process is controlled by laws, usually locally adopted, which regulate the manner and location of subdivision and the provision of improvements such as roads and drainage systems.

Subdivision regulations require a prospective developer to submit a plan (commonly a map) of his proposed scheme to a planning authority before he proceeds to make improvements or to divide and sell his land. The approval of the planning authority is contingent upon the developer's compliance with development standards as set forth in the relevant subdivision regulations. Attempting to subdivide or to sell lots by reference to an unapproved scheme renders the developer liable to civil, and often also, criminal penalties. In this way subdivision regulations can exert a significant influence on the location, manner, and timing of development. In the United States of America, for example, they have become more important than zoning controls in regulating undesirable development.

Subdivision regulations are a useful legal tool, not least because they can be made to serve so wide a variety of functions. For example, from the point of view of taxation, subdivision regulations, by requiring the registration of approved development plans, can facilitate the maintenance of accurate records of land titles.[7/] From the point of view of town planning, subdivision regulations enable the authorities to follow a coherent and consistent policy.

Aside from the issue of inherent constitutionality, which has in fact caused few difficulties in most countries, two particular legal problems are noteworthy: the first is jurisdictional and the second relates to matters of enforcement.

7/ One of the problems besetting many developing countries is an inadequate system of land registration, which makes the sale of land difficult and also undermines the tax base.

It is important that the enabling act should empower municipalities to regulate subdivisions both inside their limits and for some distance beyond. Otherwise, the municipalities will find themselves powerless to control the very areas of growth where control is most essential. A number of countries make provision for the extension of municipal jurisdiction for a fixed limit beyond municipal boundaries. For example, the Standard City Planning Enabling Act in the United States of America empowers municipalities to regulate subdivisions for a distance of five miles beyond their boundaries.

Less commonly, the enabling act may empower municipalities to extend their jurisdiction to an undetermined limit. An example of this approach is Brazilian Decree-Law 271 of 1971 which empowers municipalities to extend their jurisdiction to areas likely to be within municipal limits within the next ten years.[8/] A number of States make no provision at all for the extension of jurisdiction beyond municipal boundaries, and this legal oversight has contributed to the uncontrolled municipal growth which is characteristic of so many developing countries.

Undoubtedly, the most serious problem for many developing countries is the non-enforcement of subdivision regulations that do exist. This problem is similar to that already mentioned with regard to zoning regulations, and the general problem of non-enforcement will be discussed further in the section on enforcement.

2.2.3 Building Regulations

Buildings in disaster-prone areas are likely to be subjected to abnormally heavy stresses. The nature of the stress will vary with the type of disaster. For example, in areas of frequent tropical storm occurrence, buildings may be subjected to horizontal and uplifting wind forces. In all these areas, it is

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8/ Urban Land Policies and Land-Use Control Measures, Vol. IV, Latin America, (ST/ECA/167/Add.3), United Nations, New York, 1973 (Sales No. E.73.IV.8).

necessary to give particular attention to the design, construction and maintenance of buildings. This can be done through the adoption of appropriate provisions in municipal building regulations.9/

A building code can go a long way toward minimizing the damage attendant upon natural disasters. The code can provide for the special loads which should be taken into account when designing particular structures for a disaster-prone area and for the effective inspection of buildings under construction.

Two legal issues are worthy of special mention: the form in which the building code is expressed and the provision for appropriate procedures for enforcement. It is desirable to express regulations in functional or performance terms rather than in terms of particular design solutions. The expression of legal requirements in functional or performance terms facilitates the introduction of new methods and materials without frequent alteration of the regulations.

In reference to the provision of appropriate procedures for enforcement, it is important to emphasize that without a systematic inspection programme, it is unlikely that safe and effective standards, however carefully drafted, in fact can be attained. For example, in the United States of America one of the few states that has a state-wide building code has carefully vetted construction plans for many years. However, the state has

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9/ Virtually all the comparative work on building regulations, however titled, has been done in the context of Europe. See Evelyn Cibula, The Structure of Building Control - An International Comparison, Garston, U.K.: Building Research Station, Current Paper No. 28, 1971; C.R. Honey, International Comparison of Building Regulations: the Content and Arrangement of Regulatory Documents, Garston: Building Research Station, Current Paper No. 37, 1970; G.A. Atkinson, Building Regulations - the International Scene, Garston: Building Research Station, Current Paper No. 16, 1974; and Building Regulations in ECE Countries, United Nations, New York (Sales No. E.74.II.E.10). See also Guidelines for Disaster Prevention, Vol. 2, Building Measures for Minimizing the Impact of Disasters, United Nations, Geneva, 1976.

no field inspectorate, and its record of preventable disasters, such as from structural collapse, is one of the worst in the country. 10/ Nothing could point out more clearly the need for effective supervisory machinery to accompany desirable legislative regulations.

A building code is concerned with the physical aspects of new construction and an appropriate, regorously-enforced building code can be instrumental in mitigating the destructive effects of natural phenomena. But it is also necessary to ensure that buildings, once constructed, are maintained in good repair. Structural deterioration can be prevented by the adoption of housing and other codes, such as a fire code and codes imposing special safety conditions for structures such as hospitals and schools. The enforcement of a housing code may constitute a substantial infringement on the property rights of the individual. Under the provisions of such a code a property owner may be burdened with considerable financial obligations with respect to his property, and yet he may not necessarily be compensated by the State. For instance, he may be required at his own cost to improve structural elements of his house or even to demolish the house altogether.

Despite the infringement of vested property rights inherent in housing regulations, such regulations are constitutionally sustainable on the grounds that they are reasonably related to the protection of public health and public safety. Nonetheless, a number of constitutional attacks upon the enactment or enforcement of a housing code are possible, and it is necessary to keep these problems in mind. First of all, a housing code may violate the 'equal protection' clause of the national constitution if it establishes different requirements for persons in the same

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10/ Richard L. Sanderson, Codes and Code Administration, Chicago: Building Officials Conference of America, 1969.

class. It is a general principle of constitutional law that no one shall be denied the equal protection of the law. Article 14 of the Constitution of India is typical of the provision to be found in most national constitutions:

> The State shall not deny to any person equality before the law or the equal protection of the laws within the territory of India. 11/

If, therefore, the municipal housing code attempts to distinguish between different areas of the municipality because of the distribution pattern of natural hazards, it may violate constitutional guarantees relating to equal protection. This danger is at least minimized if, on the basis of risk analysis, care is taken to ensure: 1) that classifications of structures are based upon substantial distinctions which make one class of structure really different from another, and 2) that to whatever class of structure a regulation may apply, it applies equally to each member of the class.

The second possible constitutional challenge relates to the 'due process' provisions of national constitutions (i.e., that persons shall not be deprived of liberty or property without due process of law). Housing codes are something of a legal curiosity to the extent that they may be said to operate retroactively. Buildings in existence when a housing code is enacted are also subject to its regulatory measures. This is because housing codes merely impose requirements for certain specified uses of a structure. It can be argued that this retroactive application violates due process requirements, but nevertheless, in countries where the argument has been used, the constitutionality of the code has been upheld.

11/See also, for example, the constitution of Honduras, Articles 51 and 95; of Nepal, Article 10; of the Yemen Arab Republic, Article 22; of Trinidad and Tobago, Article 1. See also The Universal Declaration of Human Rights, Article 7; and the International Covenant on Civil and Political Rights, Article 26.

A more likely challenge is that some provisions of the code may involve a 'taking' of property without just compensation. Where, for example, as a result of a municipal housing code, a property owner is compelled to go to considerable personal expenditure to make improvements or even to demolish his property, it can be argued that he has been 'deprived' of his property without just compensation. There is a marked similarity here with the economic hardship that a zoning regulation sometimes causes. All that can be said is that it is difficult to draw a line between, on the one hand, the fair enforcement of a non-compensable regulatory measure and, on the other, the actual acquisition of property by the State, for which compensation is payable.

Finally, an additional constitutional difficulty relates to the right of entry on premises for the purpose of inspecting whether the structure conforms to disaster-related standards. Does entry for the purpose of inspection come within constitutional guarantees against unreasonable searches?12/ This problem has been theoretical in the past because inspector entry has rarely been refused, but it will no doubt arise frequently in the future, as States become more disaster-conscious and as some property owners who foresee the imposition of building modification requirements decide to challenge inspector entry in order to at least delay the making of improvements for which they may not be compensated.

12/ To take one example, in 1967 the Supreme Court in the United States of America held, in Camara v. Municipal Court (San Francisco), that "the citizen may lawfully refuse to admit the housing inspector in a non-emergency situation, where such inspector is not possessed of a search warrant or has not probable cause to believe the local housing ordinance is being violated".

2.2.4 The Problem of Enforcement

The actual administration of zoning, subdivision and building regulations is critical to their success. In particular, the enforcement of such land-use controls requires a strong administrative infrastructure, generally at the municipal level, but this is one of the areas where developing countries are weakest. Planning control in much of Africa has been severely hampered not only by lack of administrative infrastructure at the municipal level to enforce the legal regimes [13], but also, unfortunately, by corruption.[14] In the Middle East, zoning ordinances (where they have existed) have rarely been enforced in practice.[15] Throughout Asia and the Pacific region, the problem of the actual enforcement of planning regulations has proven to the weakest aspect of the planning process.[16] In some countries of the region, such as Nepal, there is no legislative provision whatsoever for enforcement.[17] In most countries an enforcement regime exists even if only in theory.

13/ To take an example, in Nigeria the state and local levels of government, which have in the past been responsible for urban planning, have had no infrastructure to monitor the implementation and the enforcement of plans. As a consequence, where land-use plans have been prepared they have often not even been put into operation. See Andrew Onokerhoraye, "Urban Land Use in Nigeria: Problems and Implications for Policy", 48 Town Planning Review (1977).

14/ Urban Land Policies and Land Use Control Measures, Vol. I, Africa, (ST/ECA/167), United Nations, New York, 1973 (Sales No. E.73.IV.9).

15/ Urban Land Policies and Land Use Control Measures, Vol. V, Middle East, (ST/ECA/167/Add.4), United Nations, New York, 1973 (Sales No. E.73.IV.9).

16/ Urban Land Policies and Land Use Control Measures, Vol. II, Asia and the Far East, (ST/ECA/167/Add. 1), United Nations, New York, 1973 (Sales No. E.73.IV.6).

17/ Ibid.

It is, therefore, correct to say that in many developing countries zoning and subdivision regulations are hardly enforced at all. This fact renders the control suggested by the existence of regulations merely theoretical and renders the regulations themselves, in many cases, utterly irrelevant. Worse still, it helps to bring the law generally into disrepute. Research is urgently required into strategies of enforcement suitable for developing countries.

As with zoning and subdivision regulations, the most important reason for the non-enforcement of building regulations is the absence of a strong administrative infrastructure. But it is also necessary to point out that the regulations are, in any case, often inappropriate. For example, there are instances in tropical areas where building codes (imported during the earlier pre-independence period) require roof truss designs to include a snow-load factor! It is essential that building regulations adopt design standards that are technologically appropriate to the local situation.

2.2.5 Public Acquisition of Land [19/]

Since the regulatory measures such as zoning and subdivision controls have proved difficult to apply in practice in many developing countries, an alternative strategy for disaster prevention is the public acquisition of land. In this way, a government can best ensure that development does not occur in areas that, on the basis of risk analyses, are regarded as particularly hazardous. Moreover, the public acquisition of such lands would raise none of the constitutional objections that can hinder regulatory measures. At least from these perspectives, the compulsory acquisition of disaster-prone lands deserves serious attention in any co-ordinated strategy of disaster prevention.

19/ See especially Urban Land Policies and Land Use Control Measures, Vol. VII, Global Review (ST/ECA/167/Add.6), United Nations, New York, 1975 (Sales No. E.73.IV.11), and, in the context of disaster prevention, see Disaster Prevention and Mitigation, Vol. 5, Land Use Aspects, UNDRO, Geneva, 1977.

In virtually all developing countries the State has the right to acquire all, or some, of the rights in land for the benefit of the community. However, in a few countries such as Afghanistan and Thailand, 20/ the relevant legislation narrowly circumscribes the right of expropriation to a few designated purposes, and there is some doubt that these purposes would extend to disaster prevention. Countries in which such restrictions exist are seriously hampered from using expropriation as a strategy in disaster prevention, and amendment of the relevant legislation is necessary. The other two issues of principal legal significance concern expropriation procedures and the question of compensation. It is beyond the scope of this study to enumerate the expropriation practices of developing countries.21/ The important question of compensation is considered in the next section.

The greatest practical difficulty with the public acquisition of land as a comprehensive strategy in disaster prevention is the cost of financing the purchase of all a nation's disaster-prone lands. In many developing countries this would double the national debt. One possibility is to acquire first those lands which risk analysis has established are the most hazardous. This has been attempted with success in Toronto, Canada, where the problem was

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20/ Urban Land Policies and Land Use Control Measures, Vol. II, Asia and the Far East (ST/ECA/167/Add.1), United Nations, New York, 1973 (Sales No. E.73.IV.6).

21/ For this, see the studies in the series Urban Land Policies and Land Use Control Measures: Vol. I, Africa (ST/ECA/167), United Nations, New York, 1973 (Sales No. E.73.IV.5); Vol. II, Asia and the Far East (ST/ECA/167/Add.1), United Nations, New York, 1973 (Sales No. E.73.IV.6); Vol. IV, Latin America (ST/ECA/167/Add.3), United Nations, New York, 1973 (Sales No. E.73.IV.8); and Vol. V, Middle East (ST/ECA/167/Add.4), United Nations, New York, 1973 (Sales No. E.73.IV.9). For the expropriation practices of developed countries, see Vol. III, Western Europe (ST/ECA/167/Add.5), United Nations, New York, 1973 (Sales No. E.73.IV.7); and Vol. VI, Northern America (ST/ECA/167/Add.5), United Nations, New York, 1973, (Sales No. E.73.IV.10).

the acquisition of 7,500 acres of floodplain land. Another possibility is to acquire those lands which have recently suffered from a disaster. This has been done, for example, in Ujung Pandang, Indonesia, where the municipality has taken over land in crowded areas with bamboo housing which had been destroyed by fire.[22/]

Because of the cost of the public acquisition of all rights in land, an alternative strategy is to purchase only the development rights in the land. By doing so, a government can prevent the development in areas where there is a high risk of natural disasters such as, for example, from landslides. This technique has been tried in the United States of America. The difficulty is that the courts have assessed compensation at a figure so high that the cost of the purchase of development rights often approximates the full market value of the land itself.[23/] Hence, the principal benefit of the technique has been lost. Nonetheless, given the various ways in which compensation is assessed in other jurisdictions, the technique may prove of some benefit to developing countries.

2.2.6 Compensation [24/]

In any legal system it is necessary to consider the question of the precise legal basis for the assessment of compensation for compulsory acquisition, and in fact the problem of compensation is probably the most crucial aspect of expropriation. Each national system has had to deal with the same basic questions: who has a compensable interest when property has been acquired compulsorily? how can the value of the property be fairly determined? what procedures of assessment and of appeal are appropriate?

22/ W. David McTaggart, "Urban Policies in an Indonesian City", 47 Town Planning Review (1976).

23/ Urban Land Policies and Land Use Control Measures, Vol. VI, North America (ST/ECA/167/Add.5), United Nations, New York, 1973 (Sales No. E.73.IV.10).

24/ See generally J.F. Garner (ed), Compensation for Compulsory Purchase: a Comparative Study, London: Sweet and Maxwell, 1975.

Entitlement to compensation relates to the question of the 'ownership' of the land compulsorily acquired, and 'ownership' must be seen as a whole complex of rights not all of which are possessed by one particular person at any one time. In systems based on Roman law there is normally only one true owner of an estate in land. But in systems based on common law there may be a number of owners of estates in the same parcel of land, and all of these persons have a claim to compensation. Moreover, most legal systems provide for a number of forms of limited ownership, and these limited owners — such as tenants and mortgagees— are also entitled to claim compensation.

The most difficult questions relate to the adequacy of compensation. As has been explained earlier, most national constitutions provide, in one form or another, that property cannot be taken without adequate compensation. Although it is well established that adequate compensation must be paid, what amounts to such compensation has been answered differently in a number of legal systems. Most laws provide for the payment of 'market value', i.e., the value which the property would command in a fair sale, between a willing buyer and a willing seller, in the open market. But a number of countries make different provision. For example, in Afghanistan the "Rules Regarding Requisition of Land for General Benefit" provide for the payment of a 'reasonable price'.[25/] In Nepal the Land Acquisition Act of 1961 provides for the payment of 'fair and reasonable value'.[26/] In Thailand the Expropriation Act of 1954 provides for the pament of compensation based on the 'value of land declared for tax purposes'.[27/]

As for the adequacy of compensation, two subsidiary questions of great importance affect the actual amount of compensation considerably: these questions relate to the losses which can be

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25/ Urban Land Policies and Land Use Control Measures, Vol. II, Asia and the Far East (ST/ECA/167/Add.1), United Nations, New York, 1973, Sales No. E.73.IV.6).

26/ Ibid.

27/ Ibid.

compensated and to the point in time at which each loss can be said to have occurred. The losses which can lawfully be compensated vary from country to country. Some countries, such as Kenya and India, provide for a 'solatium' of a certain percentage above and beyond the basic sum in order to take into account that the seller was not really willing. In addition to the value of the land itself, compensation is often granted for a number of other economic considerations, such as for the loss of standing crops and trees or for expenses relating to any change of residence forced upon the owner by the acquisition.

2.2.7 Legal Aspects of Citizen Participation in the Planning Process [28/]

Land-use planning is not merely a value-free, technical exercise. Planning decisions, including decisions regarding disaster prevention, necessarily involve the distribution of costs and benefits among social groups, and thus the decisions take on an important political character. In any democratic society it is appropriate that the decisions about the choice of values to pursue in land-use planning be made in as open and as representative a manner as possible; hence the demand, particularly in many developed countries, for greater popular participation in the planning process.

Public participation in the land-use planning process ensures, to the maximum extent possible, that whatever proposals are finally given legal force are acceptable, workable and likely to succeed. The public acceptability of planning decisions is crucial. In the absence of such acceptability, planning goals are usually frustrated. This is true in both developed and

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28/ See generally Popular Participation in Decision Making for Development, United Nations, New York, 1975 (Sales No. E.75.IV.10).

developing countries. For example, it was the lack of public acceptability that rendered unworkable the financial provisions of the Town and Country Planning Act of 1947 in the United Kingdom.[29/] To take a more general example, in Nigeria the violation of physical planning laws of all kinds is a grave problem; it is thought that many violations occur because, among other things, developers do not understand the rationale behind the rules and regard them simply as unnecessary restrictions on the freedom to develop.[30/]

At what stage should the public be allowed to participate in the planning process? The question of timing is of primary importance because broad goals and policies are usually formed early in the planning process. Each successive stage limits the options open at subsequent stages and narrows the choices available for the public to sanction. The experience of virtually all countries, developed and developing, is that once a municipality decides on certain fundamental choices of policy, these choices are not likely to be reversed on the basis of objections to its draft plan. From the point of view of legal policy, it can be argued that the most important issue with regard to citizen participation is not the modalities of the right of objection to planning proposals, but rather the extent to which the very selection of proposals involves active public participation. In almost all countries the public first becomes involved only after a draft plan has been formulated. The context of involvement is basically that of objection to the draft plan.

29/ J.B. Cullingworth, Town & Country Planning in Britain London: George Allen & Unwin, 6th ed., 1976.

30/ Popular Participation in Decision Making for Development, United Nations, New York, 1975 (Sales No. E.75.IV.10).

The structural features of the objections procedures of most countries bear a marked similarity. Provision is made for persons 'affected' by draft plans to object to them, although the definition of precisely who is such an 'affected' person varies somewhat from country to country. In any case, persons affected by the draft proposals commonly have the right of appearance before a commission of inquiry. Provision is made for the procedural and evidentiary rules which are to apply, but these rules vary so greatly from one country to another that little else of substance can be said. Finally, provision is made for ministerial review of the commission's decision and for review on points of law by a court of law.

In many countries the objections procedure to planning proposals has taken on a quasi-judicial character, that is, the essentially discretionary planning decision of the municipality or central government is preceded by a judicial-type procedure containing elaborate guarantees to ensure that all parties are heard in an atmosphere free of bias. The consequence has been that the planning process has become extremely slow. Developing countries have found it difficult to reconcile the goal of citizen participation with the urgency of the land-use decisions they are called upon to take. Decisions about disaster prevention and mitigation are more urgent still. Research is required into the question of the balance that developing countries should strike between the requirements of public participation in the planning process and the imperatives of an immediate, coherent land-use policy for disaster prevention and mitigation.

2.2.8 Taxation [31/]

Hitherto, taxation has not been much used as a land-use planning device. As a consequence, little is known about

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31/ See generally W. Attoe, T. Heller, & J. Morgan, Taxation and Land Use, 1974; and Barry A. Currier, "Exploring the Role of Taxation in the Land Use Planning Process", 51 Indiana Law Journal, 1975.

the land-use effects of various tax policies, and research in this area is needed. Nonetheless, the following tentative comments can be offered about the use of taxation as a strategy in land-use control for disaster prevention.

Taxation as a land-use device is compelling because whatever taxes a Government imposes inevitably have land-use impacts. The logical consequence of this is that governments, through the use of tax incentives and penalties, can adopt a coherent tax strategy for disaster prevention. Special tax treatment could be accorded to certain land uses. For example, flood plains could be taxed at onerous rates if developed. Some countries may encounter constitutional difficulties in applying such a tax differential because of constitutional requirements that property taxes be 'equal and uniform'. Many states of the United States of America, for example, have endeavored to create special tax classifications of real estate, but some state courts have invalidated these provisions on the grounds that they violate "equal and uniform" requirements of the state constitution. Hawaii is the only state where the taxing power is used to complement other land-use controls, but this is because Hawaii, unlike most states, does not have an "equal and uniform" provision in its constitution. 32/

Developing countries face special difficulties in using taxation as a tool in land-use control for disaster prevention. Government administration at the municipal level in many developing countries is weak. One of the weakest elements of all in municipal administration is commonly the administration of the tax system. The problem is both inadequate assessment of land for tax purposes and inadequate collection of taxes once assessed. In

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32/ Jerome G. Rose, Legal Foundations of Land Use Planning New Brunswick, Center for Urban Policy Research, 1974.

the Philippines, for example, it is thought that only about 45 per cent of the actual market value of land is used for the computation of the tax.[33/] Such a figure is by no means unusual. Under-assessment of land for taxation purposes is a substantial problem in almost all developing countries. The second problem, that of inadequate collection of taxes, is also a serious impediment to the successful use of taxation as a land-use planning device. To take one example, an Indian study revealed that a high proportion of municipalities actually collect less than 50 per cent of their assessed taxes. [34/]

Before a developing country can use taxation to fulfil land-use planning goals, certain pre-requisites must be met. The first of these is an adequate system of registration of land titles. In many developing countries, especially in Africa, the registration of land titles is at best haphazard and, in the absence of an adequate system, it is impossible to operate such land-use controls as sub-division regulations properly. The second is an evaluation of land, such as is practised in Denmark and Australia. Such an evaluation is a necessary condition for efficient taxation and, moreover, it is useful when assessing compensation in case of expropriation.

2.2.9 Insurance [35/]

In a comprehensive hazard-reduction programme, disaster insurance can complement the other tools of hazard reduction such as zoning and sub-division controls. This can be done by providing both financial incentives and penalties designed to

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33/ Urban Land Policies and Land-Use Control Measures, Vol.II, Asia and the Far East. United Nations, New York, 1973.

34/ Ibid.

35/ See Dan R. Anderson, "Development of the Principal Elements of a Comprehensive Catastrophe Insurance System", 28 Annals of the Society of Chartered Property and Casualty Underwriters, 1975.

promote the establishment of human settlements away from disaster-prone areas and also the construction of buildings in accordance with the most appropriate building standards.

At present, no country uses insurance systematically as a strategy in disaster prevention and mitigation. However, in some developed countries, and especially in the United States of America, the role that insurance can play in disaster prevention and mitigation has begun to be recognized, although governmental policies in this area are still exploratory. There has never been a comparative, global study of the disaster coverage which exists in the private market, and therefore only a few generalizations can be made. In most countries where disaster insurance exists, the coverage is fragmented. Property owners commonly have to purchase separate policies in order to insure against specific peril such as floods or earthquakes. But, it is to be noted that property owners often neglect to purchase insurance on a single peril basis. The result is that many property owners are uninsured against the very perils which most threaten their security. Moreover, whatever coverage does exist lacks strong incentives to encourage loss mitigation. Present insurance schemes, for the most part, do not contain requirements relating to the implementation of hazard reduction measures. This is a serious deficiency and, what is more, it violates a cardinal principle of insurance practice, that of attempting to eliminate, or at least to reduce, losses.

Insurance coverage must be linked to the implementation of hazard reduction requirements. Of particular interest here is the flood insurance programme in the United States of America.[36/] Under

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36/ See Office of Emergency Preparedness, Disaster Preparedness, Vol. I.

the provisions of the National Flood Insurance Act of 1968 flood insurance is made available only to municipalities which have taken affirmative steps toward minimizing flood losses by enacting and rigorously enforcing land-use control regulations. Once a municipality has established its eligibility to participate in the flood insurance programme, it must enact land-use regulations consistent with criteria established by the Department of Housing and Urban Development. Thereafter, participation in the insurance programme is dependent on the property owners themselves. While participation is not compulsory, failure to purchase insurance coverage, however, will result in the denial of various forms of federal disaster assistance to non-policy holders in an eligible community.

The National Flood Insurance Act also provides that insurance at subsidized rates is to be made available to eligible applicants up to certain maximum amounts. Additional coverage is also available, but at the actuarial premium rate for the locality concerned. The actuarial rates are determined by the Federal Insurance Administration on the basis of an evaluation of risk which takes into consideration not only the degree of exposure to floods but also the enactment of appropriate hazard-reduction measures by the municipality concerned. By virtue of the Act, the United States Government has attempted to ensure that the insurance coverage which is available to property owners is intimately linked to legally enforceable measures for hazard reduction.

There are practical difficulties for developing countries using insurance schemes as a strategy in disaster prevention and mitigation. Nonetheless, urgent consideration should be given by developing countries to the institution of state-sponsored disaster insurance programmes. In any programme of this kind a variety of issues must be considered. They include: the perils (e.g. fire, earthquake, windstorm, flood) which are to be covered, and whether the coverage should be on an all-risk

or named peril basis; the types of properties (residential, small business, big business) which are to be covered; and whether or not subsidies should be granted.

But the principal legal issue relates to the question of incentives for participation in the disaster insurance scheme. Evidence from developed countries suggests that property owners do not participate in catastrophe insurance programmes unless they are required to do so by law or by the practice of commercial lending institutions. For example, very few people have taken part in the voluntary Flood Insurance Programme, already mentioned, in the United States of America.

Similarly, there is poor participation in earthquake insurance programmes. This necessarily raises the question of the penalties that should be attached to non-participation. For example, when a disaster occurs, it is possible to withold central government financial assistance from property owners who have not purchased disaster coverage. The issue of non-participation is a particularly troublesome question of public policy, and an equitable solution to the problem has not yet been found.

Finally, it is recognized that much of the discussion about the usefulness of insurance as a strategy in disaster prevention and mitigation is rendered somewhat academic in the context of developing countries because of the weakness of the insurance sector.[37/] A possible initial strategy would be to encourage commercial lending institutions, where they exist, to insist that building loans be approved only after it has been shown that the land chosen for development is not in an area which is manifestly hazardous.

37/ See the brief discussion in Disaster Prevention and Mitigation, Vol. 5: Land Use Aspects, Ch. IV, UNDRO, Geneva, 1977.

2.3 Legal Problems Associated with Selected Natural Phenomena

2.3.1 Floods [38]

Earlier studies in this series discussed the destruction caused by riverine floods and by coastal floods (resulting from the action of tropical storms or tsunamis), and the spatial implications of flood control.[39] The Land Use Aspects volume outlined the different legal devices available to regulate land-use within a flood hazard area, particularly zoning regulations, building codes and the public acquisition of land. The fundamental legal problems relating to building codes and public acquisition, already discussed in this study, generally hold true with regard to all types of natural phenomena. Here the problems peculiar to zoning for flood control are reviewed.

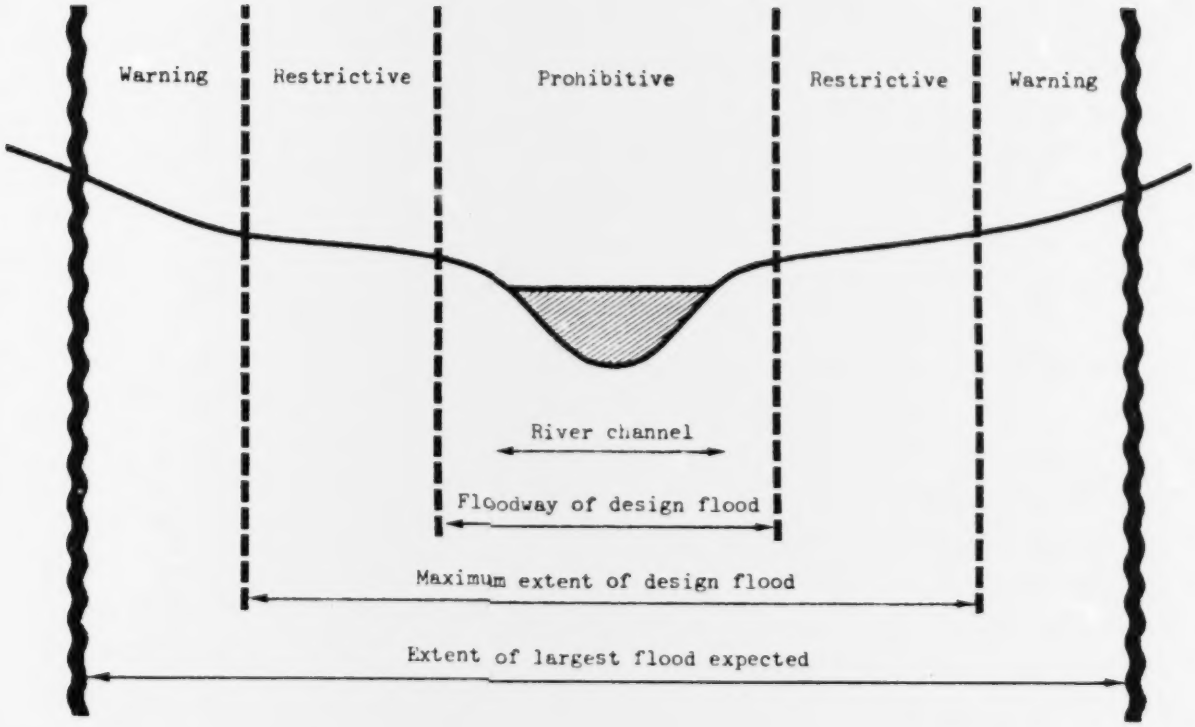
Briefly, the strategy inherent in zoning for flood control is to divide the flood hazard area into zones of prohibited or restricted uses. Figure 1 illustrates a floodplain zoned for land-use regulation. In the prohibitive zone the maintenance of an unrestricted floodway is essential. Therefore, all construction is prohibited and the area is zoned for agricultural, recreational and open space purposes. In the restrictive zone the flood hazard is less. Therefore, limited building development is permitted, but subject to stringent building code provisions relating, for example, to minimum ground floor levels. In the warning zone, flooding is rare and therefore all uses can be permitted provided that they are not prohibited or restricted by another regulation.

38/ Guidelines for Flood Loss Prevention and Management in Developing Countries, (ST/ESA/45), United Nations, New York, 1976 (Sales No. E.76.II.A.7).

39/ Disaster Prevention and Mitigation, Vol. II : Hydrological Aspects, UNDRO, Geneva, 1976; and Vol. V, Land Use Aspects, UNDRO, Geneva, 1977.

Figure 1

A floodplain zoned for land-use regulation



Two principal legal questions must be considered regarding zoning for flood hazard areas. The first is whether the central Government has 'enabled' the municipality to pass a flood zoning regulation. The second relates to the constitutionality of the regulation, assuming that there is statutory authority.

Although, as has been seen, many developed and developing countries have zoning enabling legislation, each particular enabling statute must be reviewed to determine whether it is stated broadly enough to encompass zoning for flood control purposes. Each statute commonly empowers municipalities to impose specified restrictions and indicates the purposes for which those restrictions may be imposed. Some zoning enabling statutes could be construed in such a way as to exclude the power to zone for flood control. It is not possible to assess the extent to which this has proven to be a significant problem in practice because there have been no comparative studies of flood zoning legislation, but it is not thought likely that it has.

The more troublesome question is undoubtedly the constitutional validity of the zoning regulation itself. First of all, it can be argued that any particular flood zoning regulation is a taking of property without compensation and is therefore unconstitutional. (This problem has already been discussed in the section on zoning). The next source of difficulty is the 'equal protection' provision contained in most national constitutions. It is a condition of constitutional validity that flood zoning regulations treat all property owners alike. Where, for example, one of the objectives of a regulation is to prevent channel encroachment (because channel encroachment results in significant increases in flood flows and flood hazards), an owner of regulated property may be able to claim that others equally responsible for such a burden, such as public agencies, are exempted from regulation; in such a case, the regulation would be unconstitutional.

The other principal difficulty with 'equal protection' provisions relates to the density requirements contained, explicitly or implicitly, in zoning and subdivision regulations. For example, a flood zoning regulation may permit family residences of only a certain minimum area, say an acre, in the flood fringe of a flood plain; residences of a lesser area are prohibited. From a constitutional point of view, it could be argued that property owners who possess less than an acre are not in need of greater protection, and are being treated unequally. Hence such a regulation might be held unconstitutional by the courts.

The last problem that deserves mention is the international aspect of flood control. It has already been seen that a variety of tools exist to regulate the problem of human settlements in flood plains. So long as the problem exists within a single national jurisdiction, the various legal tools mentioned in this study can be applied without inordinate legal difficulty, although the inter-jurisdictional problems may be considerable. But when a river basin falls under the national jurisdiction of more than one country, regulation becomes a great deal more difficult.

Neighboring countries have often developed flood control systems in isolation, not appreciating the extent of their inter-dependence.[40/] It is doubtful whether any rules of international law exist in this situation. There are no rules of customary international law about flood control. A second source of international law is general principles of law, but such general principles of law which may exist with regard to flood control (e.g., the general principle of good neighborliness),

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40/ K.K. Franji and B.C. Garg, Flood Control in the World, New Delhi : International Commission on Irrigation and Drainage, 1976.

are sufficiently imprecise that they are incapable of immediate application in flood control. These matters are dealt with in a number of bilateral treaties but, commonly, the provisions on flood control relate only to the maintenance of existing flood discharge conditions. This lack of State concern with the international dimension of floodplains is also reflected in the absence of scholarly studies by international lawyers.[41] Research is required into the international legal aspects of floodplain management.

2.3.2 Earthquakes [42]

Earthquakes produce a number of effects, such as surface faulting or ground shaking, which may result in loss of life and damage to property.

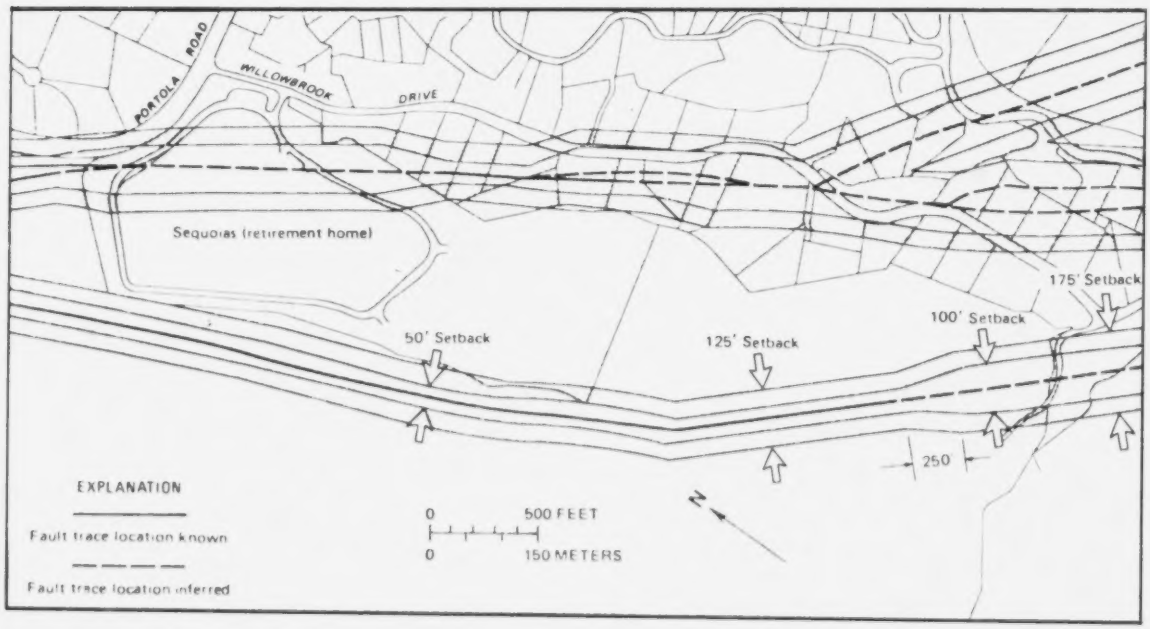
With regard to the problem of surface faulting, a number of legal devices can regulate the type and density of structures, if any, to be allowed within the area of an active fault. For example, in the vicinity of active fault traces the area can be zoned to prohibit structures altogether, and to permit only certain uses such as agriculture and recreation. At the very least, municipal zoning regulation should prohibit the building of structures for human occupancy or for public service facilities (such as bridges and utilities) on active fault traces.

41/ The singular exception is the study by the International Law Association in 1972. See their Model Treaty on Flood Control, cited in F.J. Berber, "Flood Control", in International Law Association, Report of the Fifty-Fifth Conference, London: International Law Association, 1972.

42/ See especially Disaster Prevention and Mitigation, Vol. 3, Seismological Aspects, UNDRO, Geneva, 1977, and Vol. 5, Land Use Aspects, UNDRO, Geneva, 1977. See also D.R. Nichols and J.M. Buchanan-Banks, Seismic Hazards and Land-Use Planning, Geological Survey Circular No. 690, United States Department of the Interior, Washington, D.C., 1974.

Municipalities can also establish fault hazards easements requiring various setback distances, depending on the nature of the structure concerned. Figure 2 illustrates, by way of example, the setback regulations of Portola Valley, California.

Figure 2



Example of minimum easements required for building setbacks from active fault traces by town ordinance in Portola Valley, California. All new building construction is prohibited within 100-foot wide, lightly shaded zone (50 feet on each side of the well-located portion of the San Andreas fault); structures with occupancies greater than single family dwellings are required to be 125 feet from the fault trace (dark shading). Where the location of the fault trace is less well known, the more conservative setbacks of 100 feet for single family residences and 175 feet for higher occupancies are required. (from Nichols and Buchanan-Banks, 1974.)

A second geological phenomenon produced by earthquakes is that of ground shaking. It is often earthquake-generated ground shaking which causes the most destruction. Ground shaking is one of the most difficult seismic hazards to predict and quantify, for it depends on the amplification effects of local geologic deposits, the characteristics of the earthquake source (e.g., magnitude) and the distance from the fault. Nonetheless, it is known that ground shaking is more severe on sites underlain by thick deposits of saturated sediments rather than those located on bedrock. As a result, unless precautions are taken, the greatest losses from ground shaking occur where tall structures are built on thick, relatively soft, saturated sediments.

A number of legal implications can be drawn from these findings. First of all, areas likely to be subject to severe ground shaking can be zoned for low-density land use. The most likely challenge to the legal validity of a seismic zoning regulation is on the reasonableness of the regulation relative to the available data. It is essential, therefore, that the regulation be based on a rigorous risk analysis of the area. Secondly, appropriate building code provisions can be adopted for areas with varying ground shaking characteristics. The third implication relates to existing hazardous structures. Older, non-earthquake resistant buildings constitute one of the greatest sources of destruction. This problem can be dealt with by the adoption of a hazardous building abatement ordinance which would require the improvement, or the ultimate demolition, of buildings considered particularly hazardous (although special arrangements might have to be made for buildings which are classified as being of architectural or historic importance). The most practical way to proceed is to select first those buildings that are regarded as most hazardous and having the highest occupancies, and then to deal with structures posing a lesser danger and with lower occupancies.

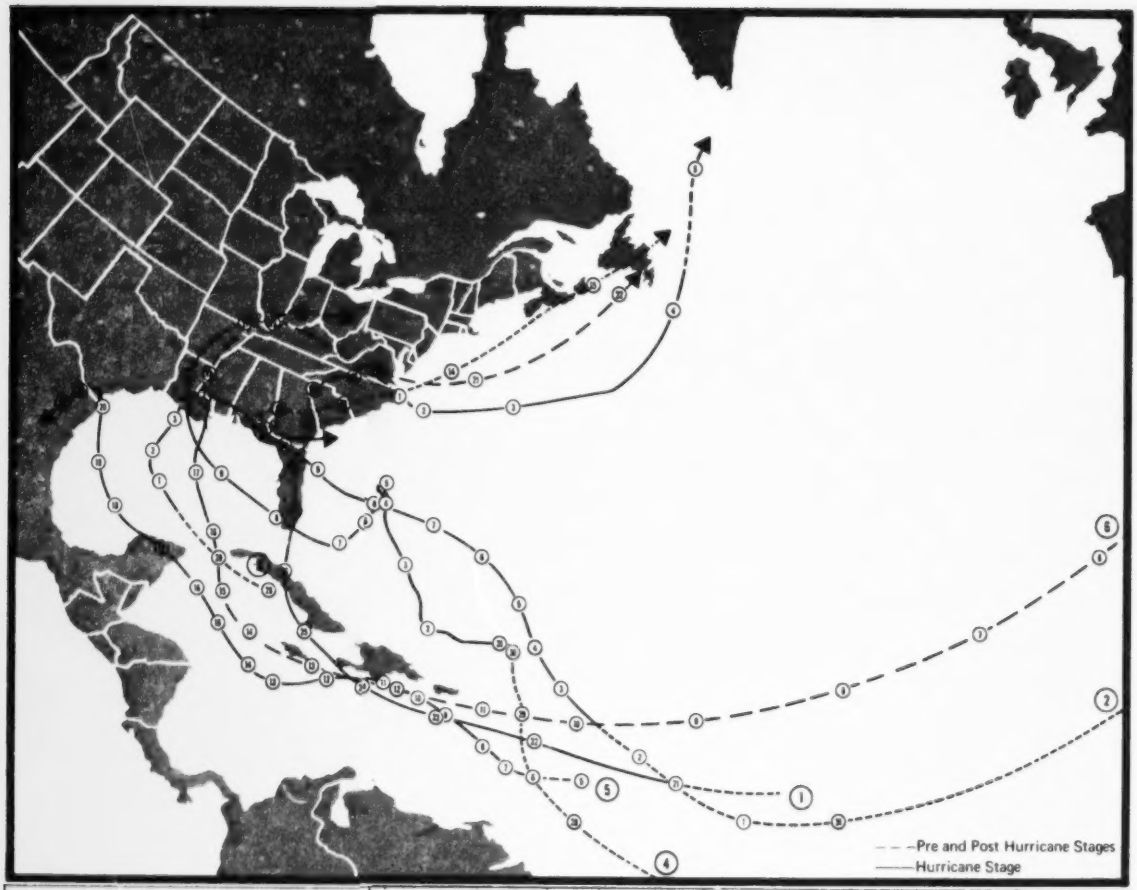
2.3.3 Tropical Storms

Tropical storms are known as hurricanes in the Atlantic Ocean, typhoons in the Pacific Ocean and cyclones in the Indian Ocean. They are extraordinarily destructive phenomena. Destruction is caused not simply by the force of the wind itself but by the rainfall associated with them, by flooding and also by storm surges.

Although it is possible to establish with some precision fault zones and the location and extent of floodplains, the area of concern for tropical storms is many thousands of square kilometers. Figure 3 shows the paths of the most destructive hurricanes affecting the United States of America in the years 1964-1967. The legal consequence of this is that zoning by itself becomes a less appropriate tool for disaster prevention.

In the absence of prohibiting structures in certain areas altogether, the usefulness of building codes is obvious. Building codes can be designed to ensure that structures can withstand the violent winds associated with tropical storms. A building code used in one of the hurricane areas of the United States of America has increased the cost of construction by 6%, but it is estimated that it has the effect of reducing by 60% the damage from winds of up to 240 km per hour. Mauritius is a good example of a developing country which has been dealing successfully with the problem of wind damage. Its building code has required the progressive conversion of dwellings from light structures with galvanized iron sheet roofing to heavy load-bearing structures with concrete roofs.

Whatever the value of zoning may be from region to region, subdivision regulations at least prove useful in providing for adequate escape routes. Approximately 90% of all lives claimed by tropical storms are in fact caused by the accompanying floods and storm surges. The single most effective means of saving lives endangered by tropical storms is prompt evacuation. The success of evacuation efforts depends on the adoption of appropriate preparedness measures.



DATES OF HURRICANE	AREAS MOST AFFECTED	DEATHS (U.S. only)	DAMAGE BY CATEGORY
1. August 20-September 5, 1964 CLEO	Southern Florida, Eastern Virginia		8
2. August 28-September 16, 1964 DORA	Northeastern Florida, Southern Georgia	5	8
3. September 28-October 5, 1964 HILDA	Louisiana	38	8
4. August 27-September 12, 1965 BETSY	Southern Florida, Louisiana	75	9
5. September 5-22, 1967 BEULAH	Southern Texas	15	8
6. August 14-22, 1969 CAMILLE	Mississippi, Louisiana, Alabama, Virginia, West Virginia	255 (68 missing 11-10-69)	9
7. July 30-August 5, 1970 CELIA	Texas, New Mexico	11	8

Figure 3

Devastating Hurricanes Affecting the United States of America, 1964-1970
The track for Celia is not shown. Category 8 damage ranges from $50 million to $500 million; category 9 from $500 million to $5 billion.

(from Disaster Preparedness, Office of Emergency Preparedness, Executive Office of the President, Washington, D.C. 20504, Vol. I, p.50).

III. LEGAL ASPECTS OF DISASTER PREPAREDNESS[43/]

3.1 General

The inevitability of the occurrence of certain natural phenomena makes it imperative that countries should plan their emergency procedures in the event of a natural disaster. By so doing, lives may be saved and property damage reduced when a disaster occurs.

For events such as tropical storms and storm surges, it is difficult to tell precisely where the disaster will strike until only a few hours before. Even for events such as riverine floods and earthquakes, whose spatial location can be determined with reasonable accuracy, and therefore for which zoning and other preventive measures can be taken, the actual occurrence of the disaster may take governmental authorities by surprise.

Much of the confusion which often ensues after a disaster strikes is caused by the lack of detailed preparedness plans. National priorities aside, the comparative absence of such plans lies in part in the episodic nature of disasters, which is difficult to deal with in legal and in administrative terms. A consequence of this is that even in developing countries where preparedness plans presently exist, they may often be incomplete or out of date, and therefore unable to provide a practical guide for effective action. For example, after the floods of July and August 1975 in the Yemen Arab Republic, relief supplies were flown in but many remained at the airport for weeks because there was no system to receive them.

The degree of disaster preparedness varies greatly from country to country.[44/] Many developing countries have no

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43/ Disaster preparedness refers to measures taken to organize and facilitate timely and effective rescue, relief and rehabilitation in cases of disaster. This study discusses only the legal aspects of preparedness.

44/ The State of Disaster Preparedness, League of Red Cross Societies, Geneva, 1974.

preparedness plans at all, but in some, rudimentary plans exist. Although this stage of preparedness may be said at least to constitute a step forward, it is doubtful whether many of these plans, relying usually on the establishment of ad hoc committees, can actually cope with a major natural disaster. The illusion of preparedness is created, and consequently a number of developing countries have already become aware of this problem and have sought UNDRO's assistance in devising preparedness plans suitable to their particular circumstances.

Every preparedness plan, despite the variety of natural phenomena that cause disasters, must deal with the same central legal issues. They must clearly outline the duties placed upon governmental and non-governmental agencies and upon individuals; ensure that there are no jurisdictional loopholes, so that no disaster-prone area is without a preparedness plan; and deal with any necessary problems of inter-jurisdictional co-operation. The plan must also ensure that agencies which are assigned particular tasks have sufficient legal power to carry them out. Few preparedness plans deal with these matters comprehensively. A model in this regard is the Example State Disaster Act in the United States of America,[45/] and repeated reference will be made to it.

3.2 Disaster Preparedness Legislation

3.2.1 Declaration of Disaster Emergencies

Legislation should make provision for the declaration of a state of disaster emergency. The legal consequences of such a declaration may be far-reaching: the ordinary procedures of governmental agencies may be suspended; emergency plans are activated; private property may be commandeered; the free movement of persons may be restricted; troops may be deployed to the disaster-stricken area; and supplies, equipment and facilities

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45/ The text of the Example State Disaster Act can be found in Disaster Preparedness, Vol. II, Office of Disaster Preparedness, Washington, D.C., U.S. Government Printing Office, 1972.

may be made available. Since the legal consequences of a state of disaster emergency are so important, it is essential that the executive order or proclamation establishing the state of disaster emergency should be both widely publicized and also filed with the appropriate records-keeping offices. It is advisable, moreover, for the sake of problems that may arise after the disaster, such as the question of compensation for property taken.

It is also advisable that some brief statutory limitation be set on the duration of the state of disaster emergency. Because the powers to be exercised during a state of disaster emergency. Because the powers to be exercised during a state of disaster emergency are so substantial, it is appropriate to restrict their exercise to some period defined by law. 46/ For example, Section 5(d) of the Example State Disaster Act of the United States of America provides that:

> ...The state of disaster emergency shall continue until the Governor finds that the threat or danger has passed or the disaster has been dealt with to the extent that emergency conditions no longer exist and terminates the state of disaster emergency by executive order or proclamation, but no state of disaster emergency may continue for longer than (30) days unless renewed by the Governor. The Legislature, by concurrent resolution, may terminate a state of disaster emergency at any time.

46/ Some constitutions deal with the problem of a state of emergency and provide for a limitation to be set on its duration. See also, for example, the constitutions of India, Article 352 (two months); of Peru, Article 70 (30 days); of Trinidad and Tobago (one month). A number of other constitutions make provision for the declaration of a state of emergency, but make no provision for a time limit. See, for example, the constitutions of Venezuela, Articles 240-244; Panama, Articles 52-53; and Paraguay, Articles 79 and 181.

A longer period is provided by Article 9 of the Brazilian Decree No. 67.347 of October 1970:

> The federal decree declaring a state of public disaster shall remain in force for a maximum of six months; it may be renewed.

Lastly, the powers to be exercised by the chief executive officer should be clearly outlined. The legislation will have to ensure that the chief executive officer has sufficient power to suspend normal governmental routines, activate the necessary emergency measures, and ensure law and order. Section 5(g) of the Example Disaster Act of the United States of America, which confers extraordinary power upon the State Governor, is a model and can usefully be quoted in full:

In addition to any other powers conferred upon the Governor by law,he may:

> (1) suspend the provisions of any regulatory statute prescribing the procedures for conduct of State business, or the orders, rules, or regulations of any State agency, if strict compliance with the provisions of any statute, order, rule, or regulation would in any way prevent, hinder, or delay necessary action in coping with the emergency;
>
> (2) utilize all available resources of the State Government as reasonably necessary to cope with the disaster emergency and of each political subdivision of the State;
>
> (3) transfer the direction, personnel, or functions of State departments and agencies or units thereof for the purpose of performing or facilitating emergency services;
>
> (4) subject to any applicable requirements for compensation under Section 13, commandeer or utilize any private property if he finds this necessary to cope with the disaster emergency;
>
> (5) direct and compel the evacuation of all or part of the population from any stricken or threatened area within the State if he deems this action necessary for the preservation of life or other disaster mitigation, response, or recovery;
>
> (6) prescribe routes, modes of transportation, and destinations in connection with evacuation;

(7) control ingress and egress to and from a disaster area, the movement of persons within the area, and the occupancy of premises therein;

(8) suspend or limit the sale, dispensing, or transportation of alcoholic beverages, firearms, explosives, and combustibles; and

(9) make provision for the availability and use of temporary emergency housing.

3.2.2 The Disaster Preparedness Unit

In countries where natural disasters often occur, it is desirable to establish a disaster preparedness unit. The size of the unit would depend on the incidence and the magnitude of disasters affecting the country.

One of the most important matters is the location of the disaster preparedness unit within the decision-making structure of the national bureaucracy. It is desirable that the unit be located within the office of the chief executive of the Government, whether at national or regional level. This office is best placed to co-ordinate the whole spectrum of activities necessary to disaster preparedness. The Fundamental Law for Disaster Preparedness of 1961 in Japan provides that the Central Disaster Relief Counter-measure Committee is established in the Prime Minister's Office. This approach is also taken in the preparedness plans of other countries. For example, in Greece Legislative Decrees 857/1971 and 356/1971 establish a National Disaster Committee under the chairmanship of the Prime Minister. In Honduras, Decree Law No. 33 of 1973 provides that the Permanent National Emergency Council is established in the Office of the President.

In most countries possessing preparedness plans, however, the disaster preparedness unit is located within the Ministry of the Interior. Less appropriate is the establishment in a number of countries of the unit in sectoral ministries such as the Ministry of Social Affairs. The location of the preparedness

planning unit in such a ministry undoubtedly encourages the curative, rather than the preventive, approach to disaster thinking.

The principal legal duty of the disaster preparedness unit is the preparation and maintenance of an up-to-date disaster plan. A disaster plan is the central aspect of preparedness, and therefore its preparation is the most important legal duty placed upon the preparedness unit. It is desirable that the plan should be given the force of law. But this issue is not as important, ultimately, as the difficulty of ensuring, as a matter of practice, that the plan is intimately known to those who must implement it and that it therefore can be implemented faithfully when a disaster occurs.

The legislation establishing the disaster planning unit should clearly outline its powers and duties. The most careful articulation of these matters is found in the Example State Disaster Act of 1972 in the United States of America. Section 6(f) of the Act provides that:

> The Division of Disaster Emergency Services shall:
>
> (1) determine requirements of the State and its political subdivisions for food, clothing, and other necessities in event of an emergency;
>
> (2) procure and pre-position supplies, medicines, materials, and equipment;
>
> (3) promulgate standards and requirements for local and interjurisdictional disaster plans;
>
> (4) periodically review local and interjurisdictional disaster plans;
>
> (5) provide for mobile support units;
>
> (6) establish and operate or assist political subdivisions, their disaster agencies, and interjurisdictional disaster agencies to establish and operate training programmes and programmes of public information;

(7) make surveys of industries, resources, and facilities within the State, both public and private, as are necessary to carry out the purposes of this Act;

(8) plan and make arrangements for the availability and use of any private facilities, services, and property and, if necessary and if in fact used, provide for payment for use under terms and conditions agreed upon;

(9) establish a register of persons with types of training and skills important in emergency prevention, preparedness, response, and recovery;

(10) establish a register of mobile and construction equipment and temporary housing available for use in a disaster emergency;

(11) prepare, for issuance by the Governor, executive orders, proclamations, and regulations as necessary or appropriate in coping with disasters;

(12) co-operate with the Federal Government and any public or private agency or entity in achieving any purpose of this Act and in implementing programmes for disaster prevention, preparation, response, and recovery; and

(13) do other things necessary, incidental, or appropriate for the implementation of this Act.

3.2.3 Local Disaster Preparedness Units

It is rare for a disaster to strike an entire country. Rather, disasters strike particular communities, and it is therefore necessary for local governments to have disaster services of their own. Most national preparedness plans neglect this. It is rare for preparedness legislation to deal with local planning.

Local planning, however, is an essential part of a national preparedness strategy. The United States of America, the Republic of Korea and Japan are three of the few countries whose legislation places a legal requirement on local communities to adopt preparedness plans. The Example State Disaster Act in the United States of America chooses the county as the appropriate local government unit and provides, in Section 8, that each county must maintain a disaster preparedness agency. The Act goes on to

provide that the State Governor is required to determine which municipalities are also under a legal obligation to establish preparedness agencies.

The most systematic allocation of responsibility for local disaster planning is provided by the Fundamental Law for Disaster Preparedness of 1961 in Japan. Article 16 provides that disaster preparedness planning units are to be established in every city, town and village. This legal requirement is well beyond the present capabilities of most developing countries. Nonetheless, circumstances may determine that this is the very best strategy to pursue over the course of time. For example, the Philippines is an extremely disaster-prone country and, moreover, is spread over a number of islands. The national communications network is weak, as is the transportation system. As a consequence, the Government has adopted what under the circumstances is undoubtedly a wise policy — over the next several years it is endeavoring to create self-sufficient Disaster Co-ordinating Councils among the 42,000 Baranjays, the most disaster-prone Baranjays being dealt with on a priority basis. The national plan also provides for the establishment of a great number of Regional, Provincial and Municipal disaster preparedness councils. Overseeing the operation of the entire system is a National Disaster Co-ordinating Council, set up in 1976, which has the duty of establishing policy guidelines on disaster preparedness and of dealing with any disasters which are beyond the capabilities of a single region.

It cannot be claimed that any one level of government is the most appropriate level for decentralized planning, because circumstances among countries vary. However, regardless of the local unit of government ultimately chosen in each country as having legal responsibility for decentralized planning, it is essential that the legal requirements actually correspond to the capabilities of the local authorities themselves. Otherwise, paper agencies will be established which will merely create the illusion of preparedness.

One final point concerns the possible necessity of co-operation among a number of the local preparedness agencies. Established political boundaries are not always appropriate for the provision of disaster services, and it may be essential to make legal provision for interjurisdictional co-operation. But such provision is rarely made. An example of a statute which does in fact bear this consideration in mind is the Example State Disaster Act of the United States of America. Under the terms of Article 8(d), the Governor may require two or more political subdivisions to form a joint disaster preparedness unit if he finds that the establishment of such a joint body is made necessary by circumstances or conditions that make it difficult to provide appropriate disaster services otherwise.

3.2.4 The role of Existing Services

It needs to be emphasized that there are a number of governmental services already in existence which are trained to meet various types of emergency, the three most obvious being the police, fire-fighting and military forces. The literature on disaster relief underscores the valuable contributions which these forces have made in preserving life and property and in maintaining order. A well-conceived disaster preparedness plan should aim to supplement these forces and not to replace them.

The preparedness plans of some countries give special recognition to the role of normal governmental services. Perhaps the best example is the "Plan ORSEC" (Organisation des secours) of France, whose purpose is to provide the départements (administrative units) in the country with a preparedness plan which is at once both a distribution of responsibilities and an inventory of existing resources in the département.[47/] The ORSEC Plan does not

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47/ See Grassin, Jean, "The ORSEC Plan - France", in Emergency Planning Digest, January - February 1977, Emergency Planning Canada, Ottawa. This article summarizes the plan's legal basis, structure and operation.

establish any new emergency organization; it is primarily an organization chart. The Plan, moreover, lays down the action to be taken by the various authorities involved in operations, so that efforts can be co-ordinated under the sole authority of the Prefect.

Section 3 of the Example State Disaster Act in the United States of America also gives legal recognition to the role of existing forces:

> Nothing in this Act shall be construed to:
>
> 3. affect the jurisdiction or responsibilities of police forces, fire-fighting forces, units of the armed forces of the United States, or of any personnel thereof, when on active duty; but state, local and interjurisdictional emergency plans shall place reliance upon the forces available for performance of functions related to disaster emergencies.

Australia provides another example. When, in 1974, the Natural Disasters Organization absorbed Australia's existing Civil Defence Organization,[48/] new emphasis was given to the threat of floods, cyclones, bushfires and other natural disasters. A principal feature of the re-organization was the expansion of the direct involvement of Australia's Defence Force and, in fact, the Natural Disasters Organization is now located administratively within the Ministry of Defence.

3.2.5 Financing

Even in the few countries with relatively elaborate disaster preparedness plans, the question of financing is commonly given little legislative forethought; yet, experience has shown that when a disaster occurs funds are needed urgently.

48/ It would be appropriate to point out here that in developed countries civil defence organizations have had to become increasingly oriented toward coping with civil emergencies caused by natural disasters. Australia's legislation formally recognizes this change of emphasis.

At the very minimum, it is desirable to create a disaster emergency funding committee to vote funds and to take action should the legislature not be in session. Consideration might also be given to the establishment of a disaster contingency fund. Many developing countries would find it difficult to create a reserve fund which may not in fact be used for a number of years. However, a number of states in the United States of America have created such funds and have found them of real usefulness.

3.2.6 Compensation

It is necessary to consider the legal position of a person who has rendered personal service or whose property has been used, and perhaps damaged or destroyed, as a result of governmental efforts to mitigate the harm caused by the disaster. In the Republic of Korea this has been formulated with some precision, 49/ but in almost no other country has this been done.

It can be assumed that in every legal system individuals must bear certain costs arising from the use of their services or property when a disaster occurs.50/ However, where the cost borne by a particular individual is high, it is not inappropriate that he be compensated by the State. It is necessary, therefore, to establish statutorily what individuals owe to the State as a matter of legal obligation and what the State has the right to demand, but only upon payment of appropriate compensation.

3.3 The International Dimension

The presence of foreign relief workers and the sending of relief supplies from abroad give disaster relief a truly

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49/ See Executive Ordinance No. 1072 of December, 1962, Articles 17-21.

50/ See the unusual provision in the Constitution of the Yemen Arab Republic. Article 16 provides that "all Yemenis shall display solidarity in meeting costs arising out of public misfortune and disasters".

international dimension. Ideally, the disaster preparedness plans of developing countries should also have an international dimension. The various questions relating to this aspect of preparedness plans are to be treated in subsequent UNDRO studies; therefore, only a brief outline of some of the problems encountered need be given here.

A number of Ministries are usually concerned with the international aspects of disaster relief. To take a few examples, the Ministry of Finance is concerned with customs facilitation and tax exemption for relief supplies coming from abroad. The Ministry of Foreign Affairs is concerned with facilitating immigration procedures for foreign relief personnel. The Ministry of Labour is concerned with questions related to work permit exemptions for international relief workers. The Ministry of Supply is concerned with co-ordinating the receipt of relief supplies coming from abroad. If problems such as these can be handled in disaster preparedness plans, the reception of foreign relief workers and foreign relief supplies can be greatly facilitated when the need for them arises.

Special problems may arise, however, if units of foreign armed services are offered for, or engage in, relief operations. Where they are already stationed in a country stricken by a disaster, "status of forces" agreements which exist may provide for this eventuality. If no agreement of this kind has been negotiated in advance, arrangements may be made to provide armed forces' relief units to work under the auspices of the United Nations, or a bilateral agreement may be concluded between the donor and the recipient country.[51/]

51/ For a discussion of the legal status of disaster relief units made available through the United Nations and circumstances if the disaster relief unit has a legal status separate from that of the United Nations, see the Comprehensive Report of the Secretary-General, Assistance in Cases of Natural Disaster, United Nations Economic and Social Council, New York, 13 May 1971 (E/4994).

IV. LEGAL IMPLICATIONS OF TECHNOLOGICAL DEVELOPMENTS

Two technological developments are potentially so far-reaching in their effects as to call for special mention. The first development concerns man's incipient capability to alter natural atmospheric processes to his benefit. The second concerns his capacity to employ satellites to gather data useful in disaster prevention and mitigation.[52/] The legal implications of both of these developments are profound, and in both cases the legal issues are barely at the stage of formulation, much less resolution.

4.1 Weather Modification [53/]

It has been established that ice crystals can be caused to form in super-cooled clouds by seeding them with dry ice, silver iodide or other nucleants. Since ice crystals are known to play an important part in the formation of precipitation, cloud seeding may become a significant method of modifying the precipitation process. The theoretical benefits of this for disaster mitigation are considerable: precipitation may be enhanced or retarded; hail may be suppressed; tropical storms may be modified. But the state of the art is uncertain. For example, in only a few experiments has it been clearly demonstrated that cloud seeding increased precipitation. In some experiments claims were made that a decrease was observed.

Experiments with hail suppression have also yielded ambiguous results. The state of scientific knowledge has a necessary bearing on the formulation of appropriate legal principles to govern

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52/ A brief summary of some present and future applications of this technology is contained in the working paper entitled The Potential Applications of Satellite Remote Sensing Technology to Natural Disasters, prepared by UNDRO for the Committee on the Peaceful Uses of Outer Space, 9 February 1977, (A/AC.105/C.1/L.92).

53/ For the most recent discussion of the science and the law, see William A. Thomas (ed), Legal and Scientific Uncertainties of Weather Modification, Durham, North Carolina, Duke University Press, 1977.

weather modification activities. Discussions in the WMO/UNEP informal meetings on Legal Aspects of Weather Modification 54/ have revealed that there is a fear that concentration on rules related to the harmful effects of weather modification activities, such as rules with regard to liability for damage, may impede the development of what is recognized to be a beneficial technology. As a result, discussions have centered on the preventive functions of administrative law, such as appropriate licensing and monitoring procedures.

As has been mentioned above, weather modification activities raise a number of complex legal problems which are still barely at the stage of formulation. Perhaps the simplest issues relate to the appropriate forms of administrative control of these activities, such as through the licensing of weather modification projects. Secondly, the most difficult group of questions relate to the liability of the weather modifier for damage that may be caused as a result of his activities. And, finally, because weather is inherently transnational, weather modification activities will often have transnational effects, and therefore important questions of international law arise.

The first general issue relates to the legal regime which regulates weather modification activities. The establishment of such a regime has in the past been considered a matter for national Governments, and legislation in fact exists in only a few countries, among them the United States of America, Canada, Australia and South Africa. Yet, at the time of writing, 74 States have, at one time or another, attempted weather modification activities (see Figure 4). It can be concluded that in most countries weather modification activities have been carried on in the absence of legal regulation.

54/ World Meteorological Organization/United Nations Environment Programme. It should be noted that discussions between these two United Nations bodies have been informal and unofficial, and no set of legal principles has been approved or adopted. See also Report of WMO/UNEP meeting of experts designated by Governments on the legal aspects of weather modification, Geneva, 17-21 September 1979.

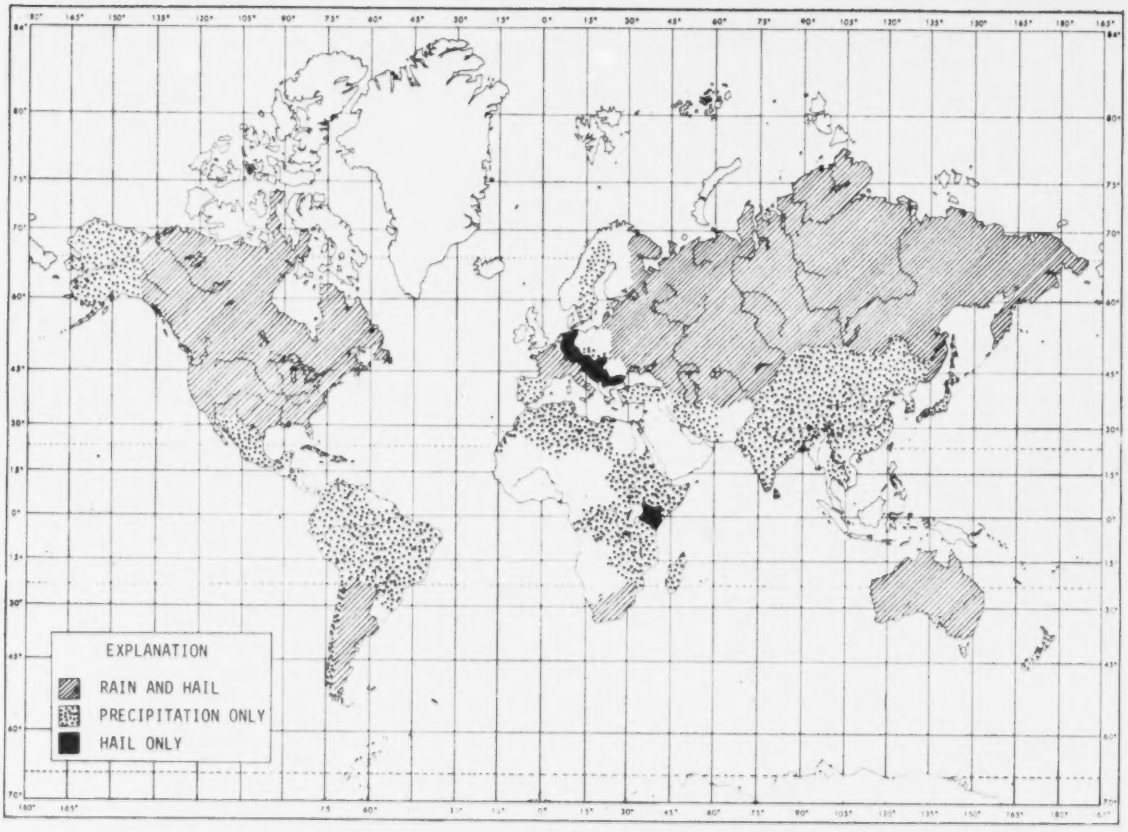

Fig. 1. Nations in which weather (precipitation and hail) modification projects (experimental or non-experimental) have occurred since 1945. (Source: Bulletin American Meteorological Society, Vol. 56, Number 1).

The country whose weather modification legislation is most developed is the United States of America, where approximately 30 states have passed legislation. However, most of the state legislation concerns only licensing procedures for the registration of individuals wishing to conduct weather modification activities. This is hardly a stringent form of control, and a number of states are in the process of considering measures to ensure more effective control, such as the submission of an impact statement, before a weather modification activity is carried out, identifying the range of possible benefits and harmful effects to local and neighbouring environments.

The inevitable increase in the use of weather modification requires States to consider desirable principles of regulation to keep apace with scientific developments. National legislation

should have as its goals the prevention of damage to persons, to property and to the environment itself. These goals can be secured by the establishment of an administrative system which provides for the licensing of weather modification operators, the authorization of weather modification projects and the monitoring of individual operations.

One objective of a national regime should be to ensure that weather modification operators have the necessary technical expertise required for the safe conduct of their operations. This can be done by licensing. The license itself would be issued subject to the demonstration of appropriate qualifications, such as the possession of the necessary skills and proven financial responsibility.

A second objective of a national regime should be the establishment of an authorization procedure for the conduct of each project. It is not appropriate here to discuss in detail the data which should be supplied in order for the responsible governmental authority to establish whether permission for the project should be granted or denied, but the data should indicate the nature of the project, the area to be affected, and the likely impact on the environment.

Finally, the national regime should provide for the registration of the data derived from weather modification operations and also for the monitoring of operations by the agency established to authorize them.

The regulation of weather modification operations also has an international dimension. 55/ Both research activities and

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55/ With reference to the international dimension of weather modification activities, the Seventh Congress of the World Meteorological Organization (May 1975) considered that international legal principles and guidelines on weather modification should be developed hand in hand with scientific progress in this field, and that a better understanding of the physical basis of weather modification was needed before the WMO would be in a position to provide definitive advice to Member States on this particular aspect of weather modification. See Abridged Report with Resolutions of CG-VII, paragraph 3.2.3.6, WMO, Geneva, 1975.

actual operations may well have transnational effects. At present in international law a State has the right to conduct weather modification operations in the air space over its territory or in international air space, and it is not clear to what extent this right is circumscribed by the rights of other States. It is also not clear, for example, whether the State desiring to conduct operations must give notice to all States that might potentially be affected. Nor has it been determined whether there is an additional obligation for the State to enter into consultations with any interested States requesting them. Further, it is not clear whether there is an obligation for the State to receive the actual consent of these other States to the weather modification operation.

In the absence of a treaty or a convention outlining the general obligations of States, the foregoing questions are difficult to answer. Customary international law has an imprecision which can only be remedied by expressing the legal obligations in treaty form. In any case, it is of interest to note that although it is generally believed that international law does not presently require their consent, states desiring to conduct some types of weather modification operations have nonetheless been reluctant to proceed without it. For example, the United States of America has been unwilling to proceed with certain tropical storm experiments in the Western Pacific in the absence of the consent of Japan and the People's Republic of China.

International legal principles concerning weather modification are now being developed. Since 1975 two informal meetings of experts have been convened under WMO/UNEP auspices to draft guidelines for general principles of State conduct.[56/] At its April 1978 meeting the experts decided to recommend nine draft principles for further discussion by the relevant bodies of the World Meteorological Organization and the United Nations Environment

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56/ See footnote 54, which points out the informal nature of these meetings.

Programme. The principles therefore have the status of recommendations, but it is probable that an eventual convention or protocol will develop along the lines indicated by them.

One of the suggested principles provides that whatever techniques are developed to modify the weather they should be dedicated to peaceful purposes.57/ Another provides that timely notification should be given to WMO of major weather modification activities; WMO, in turn, should transmit the notification to all interested States. Another suggested principle, and from the point of view of disaster prevention perhaps the most important, is that a State desiring to conduct weather modification operations should be under a legal obligation to consult with other States where the operations are likely to affect significantly the environment outside its own jurisdiction.58/

57/ In this connexion, see also the Convention on the Prohibition of Military or any Other Hostile Use of Environmental Modification Techniques, under Article I of which each State Party undertakes not to engage in "military or any other hostile use of environmental modification techniques having widespread, long-lasting or severe effects as the means of destruction, damage or injury to any other State". The Convention has now entered into force.

58/ For an example of a treaty requiring consultation, see the "Agreement Between the United States of America and Canada Relating to the Exchange of Information on Weather Modification Activities", 14 International Legal Materials (1975), p. 589. Under Article V the Parties "agree to consult, at the request of either Party, regarding particular weather modification activities of mutual interest. Such consultations shall be initiated promptly on the request of a Party, and in cases of urgency may be undertaken through telephonic or other rapid means of communication". Weather modification activities are agreed to be of "mutual interest" if they are carried out "in or over the territory of a Party within 200 miles of the international boundary" or if they are activities, wherever conducted, "which, in the judgement of a Party, may significantly affect the composition, behaviour or dynamics of the atmosphere over the territory of the other Party" (Article I).

It should be noted that the proposed obligation is merely to enter into consultations. The decision to conduct weather modification activities is now, and is likely to remain in the foreseeable future, a matter of national discretion.

It is also necessary to examine the question of liability for damage. Administrative regulation of weather modification activities does not preclude the possibility that harm may be caused to private rights as a result of such activities, either because the intended result had undesired extra-area effects or because unintended results occurred altogether. The uncertainties with regard to natural atmospheric processes, to the possibilities of their modification and to the existence of extra-area effects are so great, that it is not impossible that substantial damage may sometimes result from weather modification activities. In an early hurricane seeding experiment in 1947, off the east coast of the United States of America, the seeded hurricane veered 120° westward, causing property damage in the states of Florida, Georgia and South Carolina.

At the present time there is little judicial authority on the legal consequences of the adverse effects of weather modification activities, nor is it certain what basis of liability is appropriate. Essentially, liability may be founded on fault, that is, for damage caused as a result of negligent or otherwise wrongful acts; or liability may be absolute, that is, liability may be imposed for any damage caused by the weather modification operator, no matter how careful he may be. The trend in many countries is to impute absolute liability for activities that are regarded as ultra-hazardous. It is possible to regard weather modification as such an activity.[59/] Internationally, too, the trend is to impute absolute liability for damage caused by ultra-hazardous activities. The three multilateral conventions that

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59/ In two states of the United States of America, Pennsylvania and West Virginia, weather modification legislation specifically applies the theory of absolute liability. The Pennsylvanian statute, for example, provides that "any licensee who causes a drought as determined by the Board shall compensate farmers for damages. Any licensee who by causing damage to lands as determined by the Board shall compensate farmers and property owners for such damages".

deal with civil liability for environmental damage are based on absolute liability.60/

The problem of liability takes on an international dimension where the weather modification operation has transnational effects and damage is caused. Under international law a State bears responsibility for activities within its jurisdiction or control which cause damage to the environment of other States. This principle is articulated, for example, in Principle 21 of the Declaration of the United Nations Conference on the Human Environment:

> States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.61/

Where, therefore, transnational damage results from a weather modification operation, the State over whose territory the operation was conducted may be liable under international law for the damage done. But, again, it remains an open question as to whether that liability is based on fault or whether it is absolute.

Whatever theory of liability is adopted, both nationally and internationally, it must be proved, whenever damage follows a weather modification operation, that the damage was a result of the operation. At least in the immediate future, proof of this

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60/ They are the Convention on Third Party Liability in the Field of Nuclear Energy, 1960; the Convention on Civil Liability for Oil Pollution Damage, 1969; and the Convention on Civil Liability for Oil Pollution Damage Resulting from Exploration for and Exploitation of Seabed Mineral Resources, 1977.

61/ Report of the United Nations Conference on the Human Environnment, Stockholm, 5-16 June 1972, United Nations, New York, 1973 (A/CONF.48.14/Rev.1).

sort will be extremely difficult to establish. The range of natural variability of atmospheric processes is too great, and our present understanding of these processes and of the effects of seeding on them is too limited, to prove beyond doubt that the weather actually altered, and that damage was caused as a result of a modification operation. However, as scientific understanding improves, proof of causation will no doubt become progressively easier.

It should be added, in conclusion, that the whole question of liability for damage resulting from weather modification operations is a very sensitive one. The informal discussions between the WMO/UNEP experts, referred to previously have not dealt with the question of liability because it was strongly felt by the meteorologists participating in the WMO/UNEP meetings that, given the present stage of scientific knowledge, rules on liability would be premature and might even be counter-productive to the development of the technology. It is of interest to note that the treaty between the United States of America and Canada, mentioned earlier, also avoids dealing with the question of liability. Article VII of the treaty provides that:

> Nothing herein relates to or shall be construed to affect the question of responsibility or liability for weather modification activities, or to imply the existence of any generally applicable rule of international law.

The caution of both of these documents suggests that the problem of liability may prove to be one of the most difficult issues to resolve internationally.

4.2 Remote Sensing by Satellite[62/]

Remote sensing by satellite refers to the viewing of the earth's surface and its surrounding environment by means of sensing

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62/On the application of remote sensing to disaster prevention and mitigation, see David S. Simonett, "Possible Uses of Space Satellites for Disaster Warning, Monitoring and Damage Assessment", in The Role of Technology in International Disaster Assistance, Washington, D.C., National Academy of Sciences, 1978. For a detailed discussion of the legal aspects of remote sensing, see Nicolas Mateesco Matte and Hamilton DeSaussure, Legal Implications of Remote Sensing from Outer Space, Leyden, A.W. Sijthoff, 1976.

devices affixed to platforms orbiting the earth from the near reaches of outer space. Remote sensing is likely to prove of considerable benefit in providing information necessary for the physical planning process. This information will be of value in the adoption of land-use legislation, which, as has been seen, is one of the basic tools for minimizing disaster risk in vulnerable areas.

Remote sensing data has already proven of value in delimiting areas subject to floods with a view to adopting preventive measures. For example, data from LANDSAT, an American earth resources observation satellite, enabled planners in Bangladesh to predict areas likely to experience major flooding and to choose other areas upon which safer development could take place. Remote sensing data has also already proven useful in identifying earthquake-prone areas. Images from LANDSAT revealed that a fault line in the United States of America that had been believed to be only 5 kilometres long actually extended for 97 kilometres.

In addition to the mapping of hazardous areas, remote sensing can be applied to the monitoring of natural phenomena. To take one example, a prototype volcano monitoring system has been developed under the LANDSAT data collecting system and is being applied to 15 volcanoes in 5 countries. A further use of remote sensing data will consist in the assessment of widespread damage caused by such natural phenomena as tropical storms, forest fires and droughts.

The value of remote sensing data to disaster prevention, preparedness and relief co-ordination is manifest. However beneficial the data may be in disaster-related fields, they also have highly sensitive economic and military applications which, from the point of view of many States, dwarf in significance its other uses. As a consequence, remote sensing has raised profound questions which go to the very heart of State sovereignty: is 'information' about a State part of its 'natural wealth and resources', over which it has permanent sovereignty? 63/ Does a

63/ See United Nations General Assembly resolution 1803(XVII), 14 December 1962.

State have a right to forbid or control the sensing of its territory? does a sensed State have a right to object to the distribution of data about its territory to third parties, or at the very least, to receive and analyze data prior to its distribution to third parties? These and related questions have been the subject of discussion in the Legal Sub-Committee of the Committee on the Peaceful Uses of Outer Space (COPUOS) of the United Nations General Assembly.

Discussions in the Legal Sub-Committee of COPUOS have revealed agreement on a number of principles, but these relate, for the most part, to matters of high generality.[64/] It is agreed, for example, that remote sensing of earth is to be carried out for the benefit of all countries and in accordance with whatever principles of international law may be applicable. Draft Principle VIII, which expresses a specific obligation, is of particular relevance to this monograph:

> Data and/or information obtained by remote sensing of the earth indicating an impending natural disaster shall be disseminated as promptly as possible to those States likely to be affected (all States, priority being given to those likely to be affected).
>
> (This provision shall also apply to data and/or information obtained by remote sensing during and after natural disasters, in order to help affected States combat such disasters).

Of more significance at the present time are the areas of disagreement because they may inhibit the use of the technology. It has not yet been possible to reach agreement as to whether a State which intends to conduct remote sensing must give advance notification to States whose territory will be sensed. And, finally, it is not agreed under what circumstances a State carrying out remote sensing may disseminate data to third parties without the approval of the State or States affected.

64/ For the text of the Draft Principles, see Report of the Legal Sub-Committee on the Work of its Eighteenth Session, 10 April 1979, Annex I, United Nations, New York (A/AC.105/240).

Discussions in the Sub-Committee have been made difficult by the apparent conflict of two principles long espoused by the United Nations: the principle that peoples and nations have a right to permanent sovereignty over their natural resources and the principle of freedom of information articulated in Article 19 of the Universal Declaration of Human Rights.[65/] At one extreme, a number of States have maintained the point of view that 'information' about a State is one of the resources over which the State has permanent sovereignty, and these States have opposed even the sensing of a State without its consent. At the other extreme, some States, invoking the principle of freedom of information, have advocated a policy of open sensing and of the public, unrestricted dissemination of all data. Given the fundamental division that exists within the Sub-Committee at present, it is likely to be some time before complete agreement can be reached on a set of principles which both facilitate remote sensing activities and yet safeguard the sovereign rights of sensed States.

65/ Article 19 provides that everyone has the right to "seek, receive and impart information and ideas through any media and regardless of frontiers".

V. CONCLUSIONS

The monograph on Land Use Aspects in this series has shown that zoning, subdivision and other regulatory measures have been used by many countries as techniques of land development and land-use control, and that these techniques can be extended for the purpose of disaster prevention or for risk mitigation and management.[66/] The major legal difficulty is that many developing countries which have land-use controls do not in fact enforce them. The problem of non-enforcement is a disparate one throughout the developing world, and it will probably constitute the greatest single obstacle to the successful use of regulatory measures as strategies in disaster prevention and mitigation. The main cause of non-enforcement is the lack of administrative infrastructure in developing countries, especially at municipal level. Research is urgently required into techniques of enforcement suitable for developing countries, given their often meagre economic, administrative and other resources.

Traditional regulatory techniques pose fundamental problems of constitutional law in each jurisdiction, especially regarding the question of when a land-use regulation, which is non-compensable, becomes a 'taking' of property without just compensation. Ironically, courts have preferred not to deal with broad constitutional issues. Rather, they have preferred to examine a particular regulation on the basis of its validity or invalidity with reference to a specific parcel of land. That a municipal court tends to confine itself to the facts of the case before it points out the legal importance of proper vulnerability analysis, can provide the best evidence available that such regulations are reasonable and non-discriminatory, and therefore valid.

66/ cf. footnote 3 , page 5 of this text.

The problem of jurisdictional lacunae has proven to be a significant hindrance to satisfactory land-use control in developing countries. Acts enabling municipalities to assume jurisdiction for zoning and other purposes often restrict the exercise of the power to municipal limits. Hence, municipalities in many developing countries find they have not got the legal power to control those very areas of growth where control is most needed. This is an acute problem in much of Latin America and in the Asia and Pacific region.

The solution to the problem of jurisdictional loopholes in enabling acts is common to all developing countries where the problem exists. But for many problems, there is no such common solution. For example, it has already been seen that citizen participation in the planning process may be critical to the ultimate success of planning proposals. Yet such participation in developing countries has often had the effect of slowing down considerably the process of development and the doubt is raised whether many developing countries can afford the comparative luxury of a slow, albeit democratic, planning process.

Research is required into the question of the balance that should be struck between the requirements of public participation in the planning process and the imperatives of an immediate land-use policy for disaster prevention. It is likely that no single solution will, or ought to, command universal support. Rather, the balance ultimately struck by a developing country will be in response to its own political, legal and cultural traditions. In the same way, research is required into the use of insurance and tax strategies in disaster prevention, so that developing countries can adopt policies appropriate to their distinct requirements and traditions.

This study has also shown that the degree of preparedness varies greatly from country to country. Many developing countries have no preparedness plans at all, and few countries have plans

which can be regarded as satisfactory. Yet preparedness plans are essential if loss of life and physical destruction are to be minimized.

A number of points about national preparedness plans should be emphasized. National legislation, and regional legislation where appropriate, should make provision for the declaration of a state of disaster emergency. It is advisable that the legislation set some brief statutory limit on the duration of the state of disaster emergency. The powers to be exercised by the chief executive officer in the event of an emergency should be clearly outlined.

In countries where the incidence of natural disasters is high, it is desirable to establish a disaster preparedness planning unit. One of the most important matters is the location of the unit within the decision-making structure of the Government. It is desirable that the planning unit be located within the office of the chief executive of the Government. The legislation establishing the disaster preparedness planning unit should clearly outline its powers and duties, the principal duty being the preparation and the periodic review of a disaster plan.

Planning by local governmental authorities is an essential part of a national preparedness strategy, and local authorities should also be required to establish disaster preparedness plans. One of the most important matters for consideration in such plans is the question of interjurisdictional co-operation.

Finally, the financing of disaster-related activities is an important, but often overlooked, detail. It is desirable to create a disaster emergency funding committee to vote funds and to take action should the legislature not be in session.

This study has endeavoured to demonstrate the importance of law as an instrument of disaster prevention and mitigation. The dearth of legal studies on almost all aspects of disaster prevention and mitigation clearly supports the conclusion that comparative research into these areas of law is urgently required.

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